

Seema Bathla  
Amaresh Dubey *Editors*

# Changing Contours of Indian Agriculture

Investment, Income and Non-farm  
Employment

 Springer

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Employment

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# Contents

|          |                                                                                                                                                            |            |
|----------|------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| <b>1</b> | <b>Introduction</b> . . . . .                                                                                                                              | <b>1</b>   |
|          | Seema Bathla and Amaresh Dubey                                                                                                                             |            |
| <b>2</b> | <b>Public Investment in Agriculture and Growth: An Analysis<br/>of Relationship in the Indian Context</b> . . . . .                                        | <b>13</b>  |
|          | Seema Bathla                                                                                                                                               |            |
| <b>3</b> | <b>Dynamics of Access to Rural Credit in India: Patterns,<br/>Determinants and Implications</b> . . . . .                                                  | <b>29</b>  |
|          | Anjani Kumar                                                                                                                                               |            |
| <b>4</b> | <b>Investment Behaviour of Farmers Across Indian States:<br/>Determinants and Impact on Agriculture Income</b> . . . . .                                   | <b>51</b>  |
|          | Seema Bathla and Yashi Kumari                                                                                                                              |            |
| <b>5</b> | <b>Supply Response Function in Indian Agriculture</b> . . . . .                                                                                            | <b>75</b>  |
|          | Parmod Kumar                                                                                                                                               |            |
| <b>6</b> | <b>Analysis of Rice Productivity and Sources of Growth in India</b> . . . .                                                                                | <b>97</b>  |
|          | Elumalai Kannan                                                                                                                                            |            |
| <b>7</b> | <b>Changes in Production Structure and Class Composition<br/>in Agriculture: An Analysis of Agrarian Question Based<br/>on Punjab Experience</b> . . . . . | <b>117</b> |
|          | Balwinder Singh Tiwana and Paramjit Singh                                                                                                                  |            |
| <b>8</b> | <b>Disparities in Agriculture Income Across the Indian States</b> . . . . .                                                                                | <b>137</b> |
|          | Prabhjot Kaur and Sharanjit Singh Dhillon                                                                                                                  |            |
| <b>9</b> | <b>Income Mobility and Poverty Dynamics Across Social Groups<br/>in Rural India, 1993–2005</b> . . . . .                                                   | <b>153</b> |
|          | Amaresh Dubey and Arjan Verschoor                                                                                                                          |            |

|           |                                                                                                                                    |            |
|-----------|------------------------------------------------------------------------------------------------------------------------------------|------------|
| <b>10</b> | <b>Is Occupational Transformation in India Pro-Poor? Analysis of Rural Labour Market in the Reform Period . . . . .</b>            | <b>167</b> |
|           | Amaresh Dubey and Shivakar Tiwari                                                                                                  |            |
| <b>11</b> | <b>Shortages in Agriculture Labour Market and Changes in Cropping Pattern . . . . .</b>                                            | <b>185</b> |
|           | Sarda Prasad                                                                                                                       |            |
| <b>12</b> | <b>Determinants of Rural Nonfarm Employment and Its Implication for Rural Income Distribution: A Case Study of Assam . . . . .</b> | <b>209</b> |
|           | Anamika Das                                                                                                                        |            |
| <b>13</b> | <b>Changes in Work Patterns of Rural Women in the Context of Structural Transformation in India. . . . .</b>                       | <b>227</b> |
|           | Nancy Sebastian                                                                                                                    |            |

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# Chapter 1

## Introduction

Seema Bathla and Amaresh Dubey

The key policy agenda for independent India has been to tackle mass poverty and hunger. Almost entire lot of poor lived in rural India. It emerged that agricultural growth has to play the most important role in attaining self-sufficiency in the production of food grains, reducing poverty and eliminating hunger (Ahluwalia 1978). An increased focus on agriculture development through public investments in irrigation, input subsidies and HYV technology along with price incentives to farmers paid off. With the first phase of green revolution during the 1960s and early 1970s, India did achieve the food sufficiency objective in general and contributed significantly to poverty reduction though in a limited number of states. The foodgrain production growth has surpassed the rate of growth in population, and the country now boasts to be a net food exporter.

In the contemporary times, the Indian agriculture is at crossroads. On the one hand, it faces serious challenges of accelerating productivity and efficiency to raise farmers' income, maintaining equity and sustainability, and on the other it has to act as a prime mover behind the growth of the rural non-farm sector for poverty alleviation far more widely than during the first phase of green revolution. Apart from increased rural incomes, the development of agriculture is considered crucial for achieving food security and progress of the poorer sections of population in the less developed regions. For long, the rate of agricultural growth remained modest between 2 and 3% despite the initiation of economic reforms under the structural adjustment programme. The growth performance decelerated considerably towards the end of the 1990s culminating into an agrarian crisis in several states (Chand and Parappurathu 2012). Frequent recurrence of droughts after 1998 combined with

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inadequate irrigation facilities, credit and crop insurance facilities, high cost of inputs and less profit, fewer off farm opportunities left farmers with no choice but to end their life. The worst hit states were Maharashtra, Karnataka and Jharkhand that faced back-to-back droughts and declining agriculture incomes (Haque 2016).

The agrarian crisis seemed to be a manifestation of failure of policies at large which enabled growth in output but miserably failed to increase farm income in due course and ameliorate hardships faced by the farmers. The farm income per cultivator is nearly 34% of income of non-agricultural worker with little change over the past decades (Chand 2017). Large inter-state as well as intra-household disparities in agriculture income have now occupied the centre stage of discussion. The potential factors behind such inequalities are said to be climatic conditions and policy bias that favoured development of better resource endowed northern regions through adoption of green revolution technologies, price support measures and rapid development of irrigation and other infrastructures that other than the northern states did not get. The economic reasoning behind development of northern states has been the realisation of higher output at reasonable cost and growth of agricultural productivity at lower cost (Fan et al. 2000). The eastern and central regions, mostly rainfed and agriculturally dependent, continued to be in a low land and labour productivity trap and could not catch up with the states benefitted from green revolution. The persistent regional inequalities encompassing economic and social spheres do not speak volumes about the policies being followed across India's rural areas that may come in the way of achieving long term prosperity and sustainable development.

With an aim to overcome the agrarian crisis and foster growth, the government in 2003–04 stepped up investments in major and medium irrigation projects, National Food Security Mission, Rashtriya Krishi Vikas Yojna and expenditure on drought relief programmes. The quantum of subsidies on key inputs and irrigation machinery along with minimum support price for paddy, wheat and pulses have been enhanced to incentivise farmers to invest (Joshi et al. 2017; Bathla et al. 2017). Initiation of crop insurance scheme, soil health cards and strengthening of extension programmes have been put in place for the purpose. The government has also increased allocation of funds towards various rural infrastructure development programme, the most important ones being Pradhan Mantri Gram Sadak Yojna (rural roads), Pradhan Mantri Awas Yojna (housing for all) and Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA) (employment generation).

A big push in public expenditure in major and medium irrigation at an annual rate of growth of close to 6% and input subsidies during the periods from 2002/03 to 2013/14 seems to have led to a much higher rate of growth in private capital formation in agriculture by about 9% per annum. As a result, agriculture experienced its best and historical growth performance just under 4% from 2003–04 to 2011–12. Though slightly short of achieving the targeted annual growth rate of 4% at the national level, agriculture overcame the decelerated growth phase experienced during the 1990s. An upturn was evident in the laggard states, viz. Bihar, Chhattisgarh, Jharkhand, Madhya Pradesh, Odisha and Rajasthan that achieved higher than the all India growth rate, above 6%. A growing diversity in agricultural performance was also perceptible as share of fruits and vegetables, spices, oilseeds

and milk and eggs in total value of output of agriculture and allied activities increased. The recent NSSO's 70th round situation assessment survey of farmers (2012–13) corroborates this transformation, showing manifold increase in the share of farmers' income from livestock activities to 11.9 from 4.3% reported in the 2002–03 survey. The share of income from animal farming is reported to be more in the poorer states which also happened to be on a higher growth trajectory during the 2000s. Surprisingly, the share of receipts from cultivation recorded an increase by only 2% points to 47.9%, whereas it showed a slight decrease from non-farm business and wages-salaries. The per capita rural income at market prices surged from Rs. 5783 in 1993 to Rs. 39,556 in 2011.

Consequently upon an increase in farm income, resource allocation on employment generation programme and growth in manufacturing and construction sectors, employment in the non-farm sector appears to have accelerated. The share of non-farm employment in total rural employment has increased from 22% during 1993–94 to 35% by 2011–12. The rural poverty headcount also came down to about 14% from 37% over a span of 18 years (Thorat and Dubey 2012). Before one tries to reach conclusions on the MGREGS, it is important to understand that the response to provision of 100 days of employment to the poor is somewhat mixed. There are many who think that this flagship programme of the government has helped rural labour force to come out of distress but at the same time it has caused severe shortage of labour for agricultural operations, consequently pushing up real farm wages by about 7% per annum.<sup>1</sup> The dearth of labour is identified more in agriculturally better off states, which has put pressure on farmers to look for feasible production structure and technological and institutional changes. Notwithstanding its differential impacts across the states, the scheme does not appear to have been beneficial to women workers who remain marginalised in agriculture and receive lower wages.

The last two years (2015 and 2016) have again been appalling for the agricultural and allied sector due to an average 0.5% rate of growth amid an impressive growth of the economy at 7.6%. While the situation is less grim in the northern and southern states, farmers in the central and eastern states, mostly rainfed and some pockets of Maharashtra and Jharkhand intermittently face setbacks. Dwindling international agriculture prices, increasing input cost and declining profitability coupled with inadequate technological, crop insurance and credit support persist and add to their woes. An ever-increasing contraction in the size of land holding and hence rising share of small holders is another cause for concern. These developments are worrisome, especially in the light of recent resolution of the Union government to double farmers' incomes by 2022–23.

The bold target of doubling farmers' incomes in the next six years' rests on crop cultivation and improvement in productivity, diversification to high-value crops and agro-forestry, livestock and bee keeping, each encouraged to undergo value addition in the processing industry. The plan is also towards growth in non-farm

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<sup>1</sup>See among others, Desai et al. 2015.

activities primarily to encourage agricultural labour to move out. The strategy would work through various programmes, viz. soil health cards, investment in irrigation and rural infrastructure, use of MGRGS for groundwater and construction of ponds, and provision of e-market platform and crop insurance linked with aadhar card and bank account. Clearly, the mandate of the BJP government is to develop both farm and non-farm activities. While these two broad gateways necessitate massive public investments in irrigation, energy and rural infrastructure, cold storage and other logistics, the farm sector may require a turnaround in productivity through adoption of drought resistant crop varieties and investments in agriculture R&D and micro-irrigation systems. It is thus important to estimate the size of public investment 'in' and 'for' agriculture required under each head towards this ambitious and challenging target.

As regard the development of non-farm activities, the NSSO situation assessment survey (70th round) shows that only 31% of rural households have income from sources other than agriculture though figure varies widely within the country. The moot questions are to gauge the preference and willingness of farmers to venture into off-farm activities, action plan to encourage them into these and public resources required to develop and scaleup such operations. An upscaling of the extent of processing of agricultural commodities, which is as low as 14% (Bathla 2016) to date in India's organised manufacturing, requires massive investments to absorb the gigantic rural labour force. It is equally important to know how occupational transformation, if takes place would affect investment as well as growth in agriculture and also enable equitable distribution of income in rural areas. Another important aspect is the nature of non-farm employment that is taking place. It has mostly been unskilled casual employment which entails uncertainty of earnings and hence sheds doubt on permanent upward economic mobility. Caste, religion and education influence the rural labour market which requires strategic interventions such as education, training and skill development.

Serious deliberations are therefore called for to find an appropriate financial, institutional, and policy framework that may help to sustain the agricultural growth rate and augment farmers' incomes across the geographical locations. This volume is planned with this aim. It contains selected research-based papers written by leading researchers working in the areas of agricultural economics, poverty assessment, and labour market issues. The papers were presented at the international seminar on 'Changing Contours of Indian Agriculture with a focus on Agricultural Growth, Non-farm Employment and Rural Poverty' organised by the Jawaharlal Nehru University, New Delhi, during 12–13 March 2016. The seminar was supported by Indian Council of Social Science Research and Jawaharlal Nehru University, New Delhi.

In all, the book contains 13 chapters that focus on three broad yet inter-related themes, viz. drivers of agricultural growth and development of rural non-farm sector in India and its consequences on employment and poverty reduction. The first seven chapters examine the role of public and private investments (capital formation), prices, technology and institutional credit in incentivising farmers, accelerating growth and lessening inter-state disparities in income. The subsequent

chapters delineate the progress in occupational transformation and non-farm employment in rural areas and implications it holds for agricultural growth, income distribution and poverty alleviation. Each chapter focuses on a dis-aggregate state-level analysis, backed by primary household survey with an aim to comprehend location-specific problems in the development of farm and non-farm activities and recommend key interventions.

Chapter 2 by Seema Bathla sets the tone by empirically analysing the relationship between public investment in agriculture and irrigation and agricultural growth in the Indian context. The author constructs a time series of revenue and capital expenditure incurred by the government on agriculture and irrigation for seventeen major states covering the periods 1981–82 and 2013–14 to determine their impact on agricultural growth. The analysis reveals that low and inadequate public capital formation during the 1990s impinged upon farmers' investments and jeopardised technological change and agricultural growth. A big push in resource allocation towards agriculture and irrigation from early 2000s is an important policy initiative. A significant increase in expenditure on irrigation system in less developed states has helped to arrest deceleration in productivity growth and stimulated private investment. However, capital intensity has not increased in a significant way that could partly explain a slow pace of growth in many states. The data suggests that there are large inter-state variations in public spending, implying that the developed states tend to spend more on agriculture compared to the less developed agriculturally dependent states, except Himachal Pradesh and Jammu and Kashmir. Notwithstanding inter-state disparities, the empirical analysis based on OLS and GMM models reveals its significant impact on agriculture income. Other factors having impacted income include private investment in agriculture, non-agriculture income, land and rainfall. The findings bring forth an urgent need to accord due priority to the agricultural sector in the fiscal policy. It recommends increased budgetary outlays to the poorer states and capital deepening for higher agricultural productivity and income.

Chapter 3 by Anjani Kumar brings forth the key importance and role of institutional credit in impacting farmers' income and agricultural growth. It begins with an analysis of the changes in structure of rural credit delivery and inclusiveness of rural credit flow across states and social groups, along with identification of factors that influence the choice of credit source. Based on the unit-level data of Debt and Investment Survey carried out by NSSO during 1991–92 (48th round), 2002–03 (59th round), 2012–13 (70th round) Situation Assessment Survey of Agricultural Households, the study finds that the structure of credit market has changed overtime and the share of institutional credit has increased. The initiatives taken by the government have paid off, and the flow of institutional credit to rural areas has increased significantly even in real terms. However, regional disparity and presence of informal agencies in the disbursement of rural credit is still persistent. Rural households' access to institutional credit is influenced by the number of socio-economic, institutional and policy factors. Among many factors, education, caste affiliation, gender and assets ownership have been found to influence the rural households' access to institutional credit significantly. A concerted effort and

appropriate policy reforms are required to make rural households' access to institutional credit neutral to caste, class and regions.

Chapter 4 by Seema Bathla and Yashi Kumari analyses the investment behaviour of farmers using the decennial National Sample Survey Debt and Investment Survey (schedule 18.2) from 1981 to 2012. It begins with an analysis of spatial trends and variations in the composition of fixed capital expenditure followed by factors that determine investment in agriculture and its impact on income. The analysis reveals a phenomenal increase in per household investment from Rs. 2133 in 1981–82 to Rs. 6993 in 2012–13 at 2004–05 prices. Of this, residential land and buildings constitute a sizeable share at 68% followed by farm business at 23.3% and non-farm business at 8.7%. Capital expenditure on residential land and buildings has grown at a much higher rate (4.7%) compared to that in farm and non-farm businesses (2.52 and 3.31%), respectively, during this period. Growing urbanisation, expansion in industrial activities and low income from cultivation may have made investment in land lucrative relative to farming. The authors reiterate that a changing investment priority of farmers has implications for agricultural growth as it is done at the expense of farm assets. A slight upturn in investment in agriculture has taken place during the 2000s but its composition continues to be dominated by irrigation structures, transport and machinery. Large inter-state and inter-farm disparities in investment continue to persist. Furthermore, nearly 86% of investment is carried out through loans of which the share of institutional borrowings is 63.4%, and hence should be scaled up. The empirical analysis based on three-stage least squares lends support to these findings as investment in agriculture is found to be adversely affected by farmers' changing preference and positively by institutional borrowings and public investment. Private and public investments together with favourable incentive structure and infrastructure development exert a positive and significant impact on agriculture income. The study emphasises on upholding farmers' interest in farming in view of rapid changes in their investment priorities. According to the authors, the role of the respective state government stands imperative at this juncture in scaling up resource allocation and institutional credit to agriculture.

Parmod Kumar in Chap. 5 delves into the importance of incentives in impacting farmers' acreage allocation decisions. The supply response of farmers is examined in terms of area and yield for key crops grown in the country. The analysis undertaken from 1980–81 to 2013–14 reveals that among the price factors, real farm harvest price of own crop is most significant with a positive sign and the competing crop (real) price is significant with a negative sign. Among the non-price factors, rainfall turns out to be a significant factor in almost all the crops. Irrigation is found to be positive and significant only in wheat, rice and rabi coarse cereals. The kharif coarse cereals present a case of being rainfed crops, wherein the irrigation coefficient is most insignificant and even bears a negative sign. The lagged dependent variable is positive and significant indicating the influence of past behaviour on future decisions of the farmers. The results obtained corroborate the recent literature indicating non-price factors, especially irrigation being more prominent in farmers' acreage decision than the price factors. Yield determinants

are somewhat akin to that of area determinants. Own real price has a significant coefficient with a positive sign in wheat and coarse grains implying that profitability motive does influence yield through input usage and management. Fertiliser use per hectare is highly significant with a positive sign, indicating the changing contours of Indian agriculture which further connotes that fertiliser price subsidies might help to encourage farmers to attain higher yield. The positive effect of irrigation on yield emphasises a need for increasing major and medium irrigation including check dams to raise the productivity of the agricultural sector.

Chapter 6 by Elumalai Kannan estimates the sources of productivity growth in rice across the selected states based on the cost of cultivation surveys for ten major rice producing states for the periods from 1990–91 to 2012–13. The temporal pattern in production and the growth performance shows that all the states except Tamil Nadu registered positive and relatively high growth in yield during the recent times. However, a higher level of inter-district variation in rice productivity is observed in states such as Madhya Pradesh, Bihar and Odisha. Although average paid-out cost has increased over time, a more than proportionate increase in value of output has led to an increase in farm business income from paddy cultivation. Except Assam, all other states have shown a positive rate of growth in total factor productivity (TFP) during the periods from 1991–92 to 2012–13. However, except Andhra Pradesh, other states show no improvement in technical efficiency gains. These results imply that there exists a great potential to improve rice production through adoption of suitable modern varieties, better management practices and institutional mechanism for supply of inputs.

Chapter 7 by Balwinder Singh Tiwana and Parmajit Singh brings forth the real causes of changes in the production structure and production relations which are largely attributable to the growth of capitalism in the farm sector. Taking Punjab as a case study, the authors highlight the relevance of agrarian question from the fact that there is no comprehensive attempt to examine the impact of national and international policies on production structure and class composition in rural areas. Several attempts have been made to understand the causes of growth and stagnation of production and productivity in agriculture over the period but the real causes have remained obscure. The fundamental reason according to the authors is that the development of production forces and changes in the production structure require application of Marxian framework which is largely missing in the literature. An understanding of changes in the production relations and class composition requires institutional understating of social-political relations at the village level and changes there in over time. Till date, land ownership which is largely with the big landlords plays a central role in the determination of production relations. It is important to deal with the emerging situation for the larger interests and rights of farmers and agricultural labourers.

Chapter 8 by Prabhjot Kaur and Sharanjit Singh Dhillon investigates the convergence hypothesis in agricultural income across major Indian states over the period from 1980–81 to 2011–12. Using Barro and Sala-i-Martin and Sala-i-Martin approaches, the analysis reveals large interstate differences in the net state domestic product in agriculture. Out of 24 states taken up for investigation, only seven states

display tendency towards convergence and the remaining states show considerable divergence. The agricultural sector has grown quickly in the northern states, viz. Punjab, Haryana and western Uttar Pradesh, perhaps due to the initiatives taken by the central and the state governments through adoption of high yielding varieties, consolidation of land holdings, and assured irrigation, procurement and price support measures for foodgrains. These factors along with others may explain the widening regional income disparities. The authors suggest a need for redesigning of agricultural policies in order to achieve regional balances in development.

All the seven chapters have provided different facets of agriculture during the last 3 decades and bring forth the topical ones that have potential to contribute to higher agricultural growth and farmers' welfare. Almost all the papers call upon an integrated approach that relies on market-oriented agricultural economy with effective support from the government to develop canal irrigation, R&D and extension, infrastructure, technology, credit and institutions. A pro-agriculture and rural development approach through an increase in public investment in agriculture and irrigation and incentives would '*crowd in*' private investment (by farmers) and significantly contribute to achieve higher productivity and regional convergence in farm income. It is pertinent to know how far agricultural growth and land productivity in tandem with government employment schemes have enabled occupational transformation and 'pulled' people out of agriculture for a faster reduction in poverty. On the flip side, the 'push' factors may compel diversification into non-farm employment and may not effectively bring people out of the crisis. The remaining five chapters delve into this crucial question based on investigations in selected states.

Amaresh Dubey and Arjan Verschoor in Chap. 9 focus on income growth and poverty of rural Indian households from 1994 to 2005 using Human Development Survey data collected by the National Council for Applied Economic Research, New Delhi, during 1993–94 and the first India Human Development Survey (IHDS-I) collected during 2004–05. They focus their analysis on the gains from growth to various social groups in rural sector in India and examine how rural households have benefited from the growth of agricultural and allied sectors during 1990s and early 2000s. While examining income mobility and poverty dynamics across social groups, they report a considerable income growth among the rural households. The income growth does not differ markedly across social groups, and for considerable relative income mobility. They argue that poverty reduction has been fastest for the least advantaged groups—Muslims, Dalits and Adivasis. An analysis of poverty dynamics that underlie these changes suggests that these groups are disproportionately present among those who exit poverty and among the chronically poor.

In Chap. 10, Amaresh Dubey and Shivakar Tiwari maintain that off-farm occupation diversification contributes to household/individual well-being as well as in overall economic growth and development through an increase in productivity. In India, occupational structure appears to have remained stagnant for a long period and non-farm diversification of occupation started only in the 1980s, the rate of which has been faster in the recent period. In the period between 2004–05 and



2011–12, farm employment has declined below 50% at the aggregate level. However, the positive implication of the diversification is not satisfactory particularly in rural area. Based on the NSS data, analysis shows that farm employment is still important as around 65% of workers are dependent on agriculture for livelihood in 2011–12. Nature of non-farm employment generated is mostly casual which is largely driven by the construction sector in the urban vicinity. Even though non-farm employment in this period has been poverty reducing given an increase in the unskilled casual employment. However, the uncertainty of earnings associated with casual employment sheds doubt on permanent upward economic mobility. It does not seem to have much positive effect on investment in human capital formation at the household level. Through multinomial econometric model, the authors estimate the determinants of access to various occupations in rural areas. Mean predicted probability estimated out of the model shows caste and education are the strong determinants of most sought after regular employment. Interestingly, education remains as a strong tool of transformation since those better educated have better employment opportunity irrespective of the caste.

In Chap. 11, Sarda Prasad analyses changes in agriculture labour market and its impact on cropping pattern in selected districts in Uttar Pradesh. The author highlights that multi-dimensional factors encompassing socio-economic, environmental and agricultural marketing infrastructure influence agriculture labour market. All these factors are not mutually exclusive and static in nature. The analysis is based on primary data collected from 180 households surveyed from each Migrant and non-Migrant households from six villages in two districts of the Bundelkhand region, Uttar Pradesh, in 2011. Findings show that labour shortages in agriculture have been faced by all categories of farmers irrespective of caste and land holding, but it was mainly problematic to large farmers and high-caste households. The most serious and disheartening field operation is harvesting which has faced acute labour shortage that led farmers to skip farming or lease out land holding to the other farmers who have sufficient family labour along with machinery. It shows that leased-in land was higher among the household who have large family size, received remittances, insufficient landholding for farming and have farm machinery. Out-migration, MGRNEGA, disinterest in agricultural work and wage differential were main causes of labour shortage in agriculture. As suggested by farmers, inclusion of MGNREGA in agriculture and introduction and implementation of cooperative farming are the main solutions to overcome labour shortage problem.

Anamika in Chap. 12 examines the trends, composition and determinants of rural non-farm (RNF) employment in Assam using NSS data. In addition, she analyses the distribution of rural non-farm income based on a primary survey of 280 workers in two villages of Assam. The findings reveal that employment in Assam is mainly concentrated in construction, trade, hotel, and restaurant activities during the period from 1993–94 to 2011–12. The share of self-employed and casual workers in the non-farm sector has increased along with a continuous fall in the share of salaried workers in rural areas. The most interesting finding is the *U-shaped* relationship between land cultivated and participation in non-farm activities. A higher share of non-farm income is concentrated in households having large size of land



compared to those having a smaller land size. A positive and direct relationship between level of education and participation in non-farm activities is evident. The primary survey indicates an unequal distribution of RNF income across different land holding size households.

Extending the argument further, Nancy Sebastian in Chap. 13 maintains that the rural labor market in India is witnessing a structural transformation, with an evident shift from farm work to non-farm work. However, there are limited job options for rural women apart from agricultural work. Therefore, it becomes important to examine the change in work patterns for rural women in non-farm work opportunities like Mahatma Gandhi National Rural Employment Guarantee Act. She tries to answer questions on rural women's work participation utilising two rounds of the IHDS (India Human Development Survey) panel data (2005–2012), on what determines their choice of one job over the other? What are the socio-economic determinants of how much labour is supplied in farm work by rural women? Has amount of labour days supplied in farm activities reduced for females as compared to men? It has been observed that, in rural areas, shifting out of agriculture is mainly for males with non-farm jobs having entry barrier. There is a preference for regular salaried jobs with the rise in their income and education standards among the rural women. Days of work on farm have not declined much for rural women as compared to rural men, except for, those rural women with higher level of education and those at higher income quintiles. With limited job opportunities, agriculture still remains a main job option of women. MGNREGA mainly emerges as an alternative job option for the marginalised rural women who are poor, illiterate and from the backward classes. MGNREGA is mainly combined with farm work, probably during the lean agricultural season, and has a poverty-reducing potential for the rural households by providing employment for few days in a year yet significant in augmenting household income.

All the research-based papers are comprehensive and useful in providing insights into the public support essential to accelerate agricultural growth and income, address labour shortages and mitigate rural poverty through appropriate budgetary, technological and institutional interventions. While displaying profound concerns over growing inter-state disparities in public and private investments, credit flow and income, these selected papers thrust upon location-specific interventions for resource allocation under various schemes to bring a significant upturn in farm and non-farm incomes and eliminate poverty. The book will immensely benefit academicians, students and policy makers who have interest in agriculture and rural development and are on a look out for feasible policy interventions directed towards higher farmers' income and poverty reduction as envisaged in the current policy mandate.

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# Chapter 2

## Public Investment in Agriculture and Growth: An Analysis of Relationship in the Indian Context

Seema Bathla

### 2.1 Introduction

The brunt of a cut down in public expenditure following the economic reforms from 1991 was largely borne by the agriculture, irrigation and rural development sectors. This relative '*neglect of agriculture*' in India's fiscal policy slowed down the increasing trend in area irrigated by public canals (Gulati and Bathla 2002; Chandrasekhar and Ghosh 2002). The net area irrigated by private sources of irrigation did not increase significantly. A near stagnancy in irrigation intensity coupled with recurrent droughts and high cost of inputs led to a situation of agrarian distress (Haque 2016). To arrest the situation, almost all the states in the country increased budgetary outlays towards agriculture from early 2000s along with the drought relief measures and rural employment generation programmes. Hike in minimum support price of key crops and an increased flow of institutional credit were other policy measures, primarily taken to incentivize farmers (Chand and Parappurathu 2012). A high public expenditure priority enabled public capital formation in agriculture and input subsidies to grow at an annual rate of 6% during 2000–2013. It also led to a much higher rate of growth in private investment in agriculture at almost 9% per annum in real terms (at 2004–05 prices). The irrigation intensity rose from 30 to about 50%, and agriculture was able to attain an all time high growth at 3.8% annually during this period. The most striking feature was a phenomenal rate of growth of agriculture in many laggard states between 5 and 8%.

These outcomes suggest that public expenditure is crucial for the growth of Indian agriculture and hence should be accorded appropriate fiscal space. This chapter is an attempt to empirically test this relationship based on time series data on public investment in agriculture–irrigation and gross state domestic product

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(GSDP) in agriculture and allied activities across 17 major Indian states. This analysis contributes to the literature on several aspects. First, it is carried out over a relatively longer period of time from 1981–82 to 2013–14 to cover different phases of policy reforms. Secondly, the interrelationship between public investment and agricultural growth is tested at a disaggregate level using statewise expenditures from the Finance Accounts. Given that agriculture and irrigation are state-specific subjects, such analysis has important implications for resource allocations and possible trade-off between investment and subsidy to encourage and sustain agricultural growth. Thirdly, the relationship is tested using the ordinary least squares (OLS) and is supplemented with the generalized methods of moments (GMM) technique. The GMM has an edge over OLS as it enables to control for possible endogeneity between the public expenditure variables and other explanatory variables. The technique takes instrumental variables, which are the lagged values of the regressors and hence creates a dynamic setting to capture endogeneity.

We take forward the discussion on the impact of public expenditure on agricultural growth by providing theoretical and empirical evidence, with a particular focus on India.

The rationale behind the allocation of public resources to agriculture lies in its nature of public goods. Social benefits from agricultural expenditure are far greater than the private producer benefits, and private producers cannot extract compensation for the use of agricultural spending from all consumers. Hence, the amount spent by the private sector tends to be lower than the socially optimal level, and this underprovision creates a rationale for the public provision of such goods (Fan et al. 2008). A good example of public good is agricultural research and development (R&D). The provision of such resources to agriculture and other economic sectors helps the government to implement its development and welfare goals directly by increasing capital stock and indirectly by increasing the marginal productivity of both publicly and privately supplied production factors (Armas et al. 2012). Economic theory and empirical evidence advocates that increased agricultural productivity is important in development because it frees up resources through resource reallocation and provides raw material for the development of other sectors. It also contributes to higher income and hence higher demand by rural population for inputs, goods and services produced by the spillover effects to non-agricultural sector. Given that rapid growth of productivity is the major driver of agricultural growth, the key to regional progress out of poverty is mostly through technology adoption and increased spending on R&D (Fan 2008).

In several studies on developing economies, the focus is on composition of spending patterns which may differently affect agricultural production, growth, food security and poverty reduction. Fan and Rao (2008), Fan and Brzeska (2010) and Moguees et al. (2012) reviewed the impact of various types of public expenditures on farm output and poverty in the developing countries. Government expenditure on rural development, rural infrastructure such as transport, power and irrigation along with that on health and education influence agricultural sector through multiple pathways. Rural infrastructure has direct and indirect bearing on agricultural growth and rural poverty reduction by facilitating agricultural production and

productivity growth since its impact operates in a cumulative and multiple ways (Hazell and Haggblade 1991; Ravallion and Dutt 1995; Fan et al. 2008). The consensus from international comparison is that public investments are essential to achieve the dual objective of growth and poverty reduction, though each head has a differential impact<sup>1</sup> (Mogues et al. 2012, 2015). A good number of studies in India also corroborate these findings, i.e. the public expenditure on agriculture and rural development induces private farm investment and growth (Dhawan 1998; Gulati and Bathla 2002; Bathla 2014).

While the significance of public investments cannot be undermined, input subsidies are widely used to support agricultural production all over the world. Empirical evidence on the issue of allocation of public resources towards farm investments vs. subsidies is somewhat mixed. For example, in the Indonesian case, Armas et al. (2012) found a positive impact of public spending on agriculture and irrigation, while spending on fertilizer subsidies had an opposite effect on growth during the period 1976–2006. In India, recognizing the imbalance between subsidies and public agricultural expenditure, several studies posit that this phenomenal increase in subsidies has adversely affected public investment in agriculture and hence should be streamlined<sup>2</sup> (Gulati and Narayanan 2003; Mogues et al. 2012). Furthermore, the input subsidies which were considered crucial at the initial stage of Green Revolution in the 1960s and 1970s in adoption of new technologies in India showed diminishing marginal returns during the eighties and up to mid-nineties (Fan et al. 2008). The analysis for the recent period carried out by Bathla et al. (2017) from 1981–2013, however, finds fertilizer subsidy, which seems to have again assumed importance although higher marginal returns continue to be from investments in agricultural R&D, education, health, and energy.

Clearly, more research is needed on the subject regarding complete withdrawal or rationalization of subsidies in agriculture. A few studies support input subsidies in raising private investment and accelerating productivity of certain crops in certain regions, albeit imbalance in the use of NPK (Sharma 2013; Chand and Kumar 2004). Similarly, Chand and Pandey (2008) cautioned on a complete removal of fertilizer subsidy as it would lead to a 9% reduction in food grain production in India. A growing literature on the subject from the African countries favours an increased public expenditure towards subsidies as it may provide incentives to private investment under certain conditions and trigger agricultural growth (Chirwa and Dorward 2013). This might also be the case in India during the last decade

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<sup>1</sup>Fan (2008) indicated that crop research has helped reduce large numbers of rural poor people. It is estimated that every \$1 million invested at the International Rice Research Institute (IRRI) in 1999 would lead to more than 800 or 15,000 rural poor people lifted above the poverty line in China and India, respectively.

<sup>2</sup>A cut down in subsidies in India was also suggested to address other associated issues including inequity across states, farm size and crops, resource use inefficiency and environmental degradation from overuse of land and water resources.

when government increased the magnitude of subsidies along with investments that, along with other factors, may have triggered higher growth.

In this chapter, we quantify the relationship between public expenditure on agriculture and irrigation and agriculture income from 1981–82 to 2013–14 using a single equation model. The next section explains the analytical approaches and presents temporal and spatial trends in public expenditure (revenue and capital) on agriculture and irrigation and their composition. Section 2.3 presents empirical results, and Sect. 2.4 summarizes the findings and draws key conclusions.

## 2.2 The OLS and Dynamic Panel Approaches and Data

The basic OLS regression equation specifies agriculture income as a function of public investment on agriculture and other factors.

$$\begin{aligned} \text{Log GSDPA}_t = & \alpha \log \text{Public Agri R\&D}_{t-1} + \chi \log \text{Public Irrigation}_{t-1} \\ & + \varphi \log X + s_t + v_t + \varepsilon_t \end{aligned} \quad (2.1)$$

Where gross state domestic product agriculture per capita (GSDPA) in period  $t$  is explained by per hectare public investment in agriculture R&D and irrigation (both lagged),  $X$  is a vector of variables, viz. lagged private investment in agriculture, per capita non-agriculture income, weather conditions represented by rainfall, availability of land and labour (employment/ha). The  $\alpha$ ,  $\chi$  and  $\Phi$  represent the respective coefficients of the explanatory variables. Public spending on agriculture and minor–medium–major irrigation is taken separately to account for their individual effects. Input subsidy is not considered as expenditure on it is subsumed in agriculture and irrigation heads. Non-agriculture income may also capture urbanisation that promotes jobs out of agriculture, resulting in an increasing share of nonfarm activities in the income portfolio of rural households. Land, employment and rainfall represent the control variables, which are taken to influence agriculture growth in the same year. The  $s_t$  are state fixed effects, and  $v_t$  are vector of period dummies taken to capture time trends.

The OLS estimates are biased if lagged independent variables are correlated with the dependent variable, we introduce state fixed effects to control for state-specific and time invariant factors that influence agriculture GSDP. The bias may remain as the residual may have time varying and state-specific factors that influence income. If such factors are correlated with investments, then the estimated coefficients of  $a$  and  $b$  are biased. Further, the relationship between agriculture and non-agriculture income is bidirectional in India. There is a possibility of a simultaneity bias within the explanatory investment variables and the dependent variable, i.e. agriculture income. The Hausman test confirms the presence of endogeneity problem.

These biases can be addressed by estimating a system of moment equations using a difference or system GMM technique (Arellano and Bond 1991; Blundell and Bond 1998). Arellano-Bond estimation begins by transforming all the regressors, usually by differencing. The relationship is examined within a dynamic setting based on lagged levels of the variables as instruments in the first differenced equation (Roodman 2006). Investment variables specified in the equation are used as instruments with first and second lags along with first lag of GSDPA and GSDP. The following equation is estimated using first difference specification—xtabond2 command in Stata.

$$\Delta \log \text{GSDPA}_t = \alpha (\Delta \log \text{Public R\&D}_{t-1}) + \chi \log(\Delta \text{Public Irrigation}_{t-1}) + \varphi(\Delta \log X) + \Delta v_t + \Delta \varepsilon_t \quad (2.2)$$

The data base relates to 17 major states from 1981–82 to 2013–14. These include Andhra Pradesh, Assam, Bihar, Gujarat, Haryana, Himachal Pradesh, Jammu & Kashmir, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Odisha, Punjab, Rajasthan, Tamil Nadu, Uttar Pradesh and West Bengal. Data is compiled from various sources, viz. Finance Accounts, Statistical Abstract of India, Agricultural Statistics at a Glance, Fertilizer Statistics and NSS AIDIS (schedule 18.2) for private investment (by rural farm households) in farm business. The NSSO All India Debt and Investment Survey (AIDIS) were carried out in 1981, 1991, 2002 and 2012. Using exponential rate of growth, the estimates are interpolated to generate a time series on farmers' investment. The expenditures in three newly created states, Chhattisgarh, Jharkhand and Uttaranchal, are available from 2000 onwards, and their respective parent states viz. Madhya Pradesh, Bihar and Uttar Pradesh are merged to create consistent series.

The public expenditure series, private farm expenditure (investment) and other data set are reported in nominal prices. These have been converted into real prices at 2004–05 base using GSDP deflator from EPW Research Foundation. The impact of investments on agriculture R&D and irrigation usually lasts more than one year, and we have considered capital expenditure as capital stocks using a 10% depreciation rate in the empirical model based on the existing literature (Fan 2008; Fan et al. 2008). Agriculture R&D is broadened to include expenditure on soil conservation, crop and animal husbandry as these heads do have research components. The series on capital stock is added to revenue expenditure, which is mainly incurred towards meeting day-to-day expenses and subsidies. The time series on stock plus revenue are used only in the empirical analysis. It is important to mention that the economic and functional classification in the budget and finance accounts have changed since 1987 and extra efforts have been made to adjust the expenditure data in the period 1981–1986 under various heads to match with the new budgetary classification.

### ***2.2.1 Temporal and Spatial Trends in Public Expenditure on Agriculture and Irrigation***

Public expenditure in India is broadly categorized as development and non-development expenditure, which are further bifurcated into revenue (current) and capital expenditures. Capital expenditure refers to expenditures usually borrowed for capital formation such as asset creation, machinery and construction. Expenditures on agriculture and irrigation heads are highly decentralized. Funds are routed through the central government to the respective state governments and the former also spends directly on many economic and social services. The responsibility of incurring expenditure on agriculture as well as irrigation-flood control lies squarely with the states. Within agriculture, expenditure on various flagship programs and also R&D is undertaken by the central government, but is routed through the state budgets. Only the outlays on interstate rivers and fisheries outside territorial waters, fertilizer and food subsidy are predominantly undertaken by the central government. In this study, the expenditure by the central government and loans and advances are not taken to avoid double counting.

The data shows that total public expenditure of all the states has expanded by more than 7 times from 1981/82 to 2013/14, growing at a rate of 6.7% per year. Development expenditure increased at 5.8% annually, much slower than non-development expenditure at 8.3%. As a result, the share of development expenditure declined continuously from 75% in 1980 to around 65%. It is also promising to see that development expenditure has consistently outgrown population growth, and per capita development expenditure increased from 1,513 in 1981 to Rs. 7,270 in 2013.

Expenditure on agriculture and irrigation heads fall under the economic services. It is found that on average, nearly 25% of expenditure was allocated to irrigation and flood control, followed by agriculture and allied activities at 19.2%. Although the amount spent on these heads as well as on others within the economic services has more than doubled in the post-reform period, it is alarming to notice that the share of agriculture, irrigation-flood control fell substantially. It could be due to low growth in capital expenditure (investment) for irrigation schemes. Expenditure in agriculture and allied activities also grew at a slow pace.

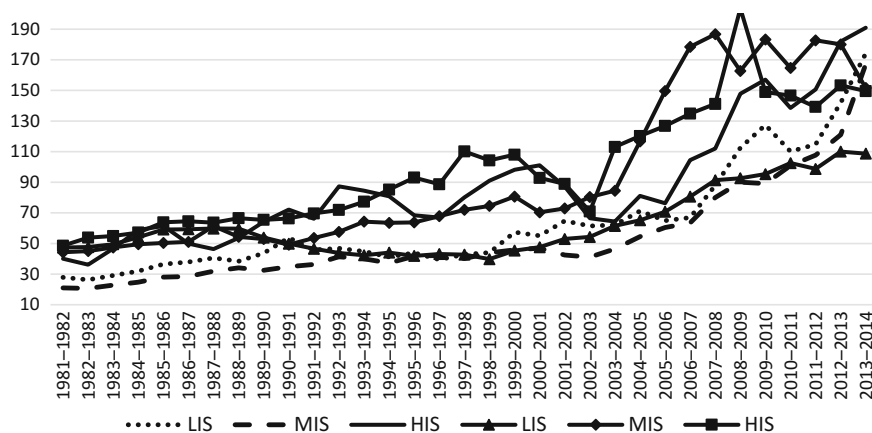
Table 2.1 reveals that public expenditure on agriculture has increased from Rs. 90.38 billion to Rs. 454.15 billion at an annual rate of 4.59% during 1981–2014. In contrast, irrigation and flood control expenditure has stepped up from Rs. 150.99 in TE 1984 to Rs. 477.79 billion by TE 2014, and grew at a modest 4% rate. Large variations in these expenditures are visible across the states, showing a higher rate of growth near 5% in Gujarat, Karnataka, Kerala, Madhya Pradesh, Odisha, Punjab, Rajasthan and Uttar Pradesh. In case of irrigation, Andhra Pradesh, Himachal Pradesh, Karnataka, Maharashtra and Tamil Nadu have taken a lead. It is also clear that the richer states have taken a lead in allocating more outlays including that on input subsidies.



**Table 2.1** Public expenditure on agriculture and irrigation (Rs. billion) and % share of capital expenditure (2004–05 prices)

|                | Agriculture |         | % capital formation |         | Irrigation and flood control |         | % capital formation |         | Annual rate of growth: 1981–2014 |            |
|----------------|-------------|---------|---------------------|---------|------------------------------|---------|---------------------|---------|----------------------------------|------------|
|                | TE 1984     | TE 2014 | TE 1984             | TE 2014 | TE 1984                      | TE 2014 | TE 1984             | TE 2014 | Agriculture                      | Irrigation |
| Andhra Pradesh | 5.37        | 28.45   | 1.61                | 1.34    | 15.94                        | 114.71  | 57.17               | 57.29   | 4.56                             | 7.11       |
| Assam          | 3.98        | 12.11   | 5.73                | 1.33    | 3.40                         | 10.88   | 74.29               | 61.81   | 2.08                             | 2.59       |
| Bihar          | 4.72        | 26.56   | 6.8                 | 5.63    | 11.89                        | 27.98   | 72.82               | 65.07   | 4.02                             | 2.04       |
| Gujarat        | 4.02        | 27.9    | 24.42               | 16.3    | 13.19                        | 47.84   | 52.85               | 86.45   | 5.46                             | 3.91       |
| Haryana        | 2.36        | 14.38   | 2.94                | 26.14   | 6.25                         | 10.99   | 56.4                | 40.58   | 3.6                              | 1.98       |
| Himachal Pr    | 2.58        | 7.98    | 8.61                | 5.02    | 0.48                         | 3.35    | 58.39               | 48.59   | 3.28                             | 7.45       |
| J&K            | 2.03        | 10.31   | 6.4                 | 27.04   | 1.80                         | 4.60    | 67.43               | 48.96   | 4.88                             | 3.68       |
| Karnataka      | 4.6         | 48.05   | 2.88                | 2.76    | 9.64                         | 34.49   | 56.93               | 88.07   | 7.30                             | 4.57       |
| Kerala         | 3.37        | 24.48   | 11.18               | 7.48    | 3.89                         | 5.46    | 72.75               | 47.17   | 5.59                             | 0.77       |
| Madhya Pr      | 10.76       | 56.8    | 6.46                | 3.18    | 11.73                        | 37.98   | 80.17               | 84.16   | 4.96                             | 3.75       |
| Maharashtra    | 18.33       | 54.88   | 3.44                | 17.2    | 20.07                        | 66.32   | 62.59               | 73.94   | 3.11                             | 4.85       |
| Odisha         | 3.8         | 22.56   | 11.57               | 3.01    | 7.79                         | 17.42   | 84.39               | 64.42   | 4.57                             | 2.50       |
| Punjab         | 2.43        | 7.56    | –                   | 2.25    | 5.13                         | 9.02    | 58.37               | 26.93   | 5.8                              | 1.64       |
| Rajasthan      | 2.64        | 17.82   | 7.95                | 8.98    | 8.83                         | 12.67   | 56.96               | 36.29   | 5.25                             | 1.72       |
| Tamil Nadu     | 7.88        | 37.32   | 12.62               | 13.25   | 4.2                          | 14.18   | 39.82               | 62.34   | 4.34                             | 4.31       |
| Uttar Pr       | 6.28        | 37.88   | –                   | 12.21   | 22.86                        | 47.93   | 53.11               | 38.41   | 5.97                             | 2.07       |
| West Bengal    | 5.11        | 15.08   | 9.97                | 12.44   | 4.34                         | 9.63    | 37.01               | 42.26   | 3.03                             | 2.78       |
| All states     | 90.38       | 454.15  | 6.45                | 9.57    | 150.99                       | 477.79  | 61.04               | 63.83   | 4.59                             | 4.0        |

Source: Finance accounts, Government of India, various issues (1981–2013)



**Fig. 2.1** Public expenditure on agriculture and irrigation (Rs. billion at constant (2004–05) prices). *Source* Bathla et al. (2017)

For greater clarity, states are also grouped into low, middle and high income based on average per capita income during the period 2000–13 (details given in Bathla et al. 2017). Accordingly, seven states fall under high-income category, five each in the middle- and low-income categories. Low-income states (LIS) include Bihar, Uttar Pradesh, Assam, Jammu & Kashmir and Madhya Pradesh; medium-income states (MIS) are Odisha, Rajasthan, West Bengal, Andhra Pradesh and Karnataka; and high-income states (HIS) include Punjab, Himachal Pradesh, Tamil Nadu, Kerala, Gujarat, Haryana and Maharashtra. Figure 2.1 depicts the magnitude of expenditure in agriculture and irrigation has significantly increased in every state since early 2003–04. But it has shown a consistent increase in the less developed agriculturally dependent states, which is a welcoming policy initiative by the respective state governments.

Despite a manifold increase in public spending on both revenue (current) and capital accounts, an important concern is that the latter, which is primarily towards capital formation (synonymous with investment), has not increased in a significant manner. Taking all states together, the percentage share of capital expenditure in total expenditure on agriculture has increased from 6.45 to 9.57% and on irrigation from 61.04 to 63.83% (Table 2.1). A significant increase in capital spending on irrigation is visible only in Gujarat, Karnataka, Madhya Pradesh, Maharashtra, Tamil Nadu and West Bengal. A lesser share of investment indicates that government expenditure is more towards day-to-day administrative expenditures including subsidies. According to Chandrasekhar and Ghosh (2002), a consistent cut in expenditure on capital account during the 1990s and a concomitant hike in current expenditure were possibly to achieve targeted fiscal deficit, which might have affected investments in key sectors. Although one may see a revival in spending from 2003–04, the capital intensity continues to be the same in agriculture and irrigation in each state with a few exceptions. As such, the share of capital

expenditure in development expenditure remains low at 15% which persists at the sectoral level as well. Lower share of capital expenditure in total expenditure may also imply mounting bureaucracy and inefficiency, especially on major and medium canal irrigation systems (Bathla 2016).

As shown in Table 2.2, there has been a change in the composition of spending on agriculture towards food storage–warehousing, forestry and medium irrigation. The main subheads relate to agricultural and allied services include crop husbandry, forestry, livestock development and medium irrigation within the irrigation and flood control. Expenditure for TE 2014 shows the share of crop husbandry is the maximum in most of the states at nearly 34% in low-income state (LIS), and high-income states (HIS) and 39.8% in middle-income states (MIS), followed by forestry (15.3%), animal husbandry, food storage (10.6 and 11.98%) and cooperation (9.63%). Expenditure on dairy development has decelerated since the 1990s while large amount of resources seems to have been diverted to activities such as food storage and warehousing and research. One may see a much higher share of food storage and warehousing in total agriculture expenditure. It is relatively higher in LIS and MIS at 15 and 11.6% than that in HIS at 5.5% which could be explained by a larger number of poor in LIS and MIS and hence government intervention for stocking food.

The agriculture R&D share is less than 10% in HIS and much lower in other groups at 6%. This is worrisome given a deceleration in productivity growth of many crops and also the fact that R&D activity in agriculture is hardly undertaken by the private sector in the country. As share of agricultural GDP, India spends 1% on agri-R&D which is fairly low in comparison with its 3% share in the developed countries. Even if agricultural R&D is expanded by taking expenditure on soil conservation, crop and animal husbandry, its share in GSDP agriculture reaches to maximum 2%. This may have serious implications for agriculture and food production in the future.

Further, among various types of irrigation expenditures, the highest share is occupied by medium and major irrigation system across the states. The LIS spend more on minor irrigation and its share in total expenditure on irrigation stands at 27.68% during TE 2013–14 compared to 4.81 and 16.64% in MIS and HIS. MIS spend substantially on flood control that is visible from its high proportion in total irrigation expenditure at 62.8%. This may have also cut down spending on irrigation. The annual rate of growth in minor irrigation is much higher at 11.95% compared to that in the major–medium irrigation systems at 5.75%. An increasing investment in minor irrigation, mainly tanks and tube wells, can be explained by long gestation periods in the construction of canals and also growing inefficiency. It is an important step, especially knowing that the marginal efficiency of capital is much higher in minor irrigation than that in major–medium irrigation in each state (Bathla 2016).

In the face of large interstate variations in public expenditure on agriculture and irrigation, it is important to see it on per hectare basis. Table 2.3 provides estimates on agriculture R&D, irrigation (excluding flood control) along with private investment in agriculture as these heads have direct bearing on agricultural

**Table 2.2** Composition of public expenditure in agriculture and % share of each at constant (2004–05) prices

|                                     | TE 2014 |        |        |        | Annual % growth rate 2000–13 |       |       |       |
|-------------------------------------|---------|--------|--------|--------|------------------------------|-------|-------|-------|
|                                     | LIS     | MIS    | HIS    | All    | LIS                          | MIS   | HIS   | All   |
| <b>Agriculture (Rs. billion)</b>    | 143.65  | 131.95 | 174.5  | 454.15 | 8.77                         | 10.64 | 7.82  | 8.93  |
| <b>% share of:</b>                  | 100     | 100    | 100    | 100    |                              |       |       |       |
| Crop husbandry                      | 33.99   | 39.8   | 33.6   | 35.39  | 10.98                        | 16.08 | 10.66 | 12.31 |
| Soil and water conservation         | 4       | 2.64   | 6.15   | 4.35   | 2.22                         | 2.18  | 8.67  | 5.03  |
| Animal husbandry                    | 10.58   | 9.88   | 11.11  | 10.59  | 7.62                         | 6.65  | 8.46  | 7.78  |
| Dairy development                   | 1.32    | 2.74   | 3.19   | 2.44   | 15.59                        | 9.32  | −7.13 | −2.02 |
| Fisheries                           | 1.91    | 2.23   | 3.73   | 2.65   | 8.95                         | 6.52  | 11.94 | 9.56  |
| Forestry and wildlife               | 19.94   | 13.33  | 13.14  | 15.36  | 5.89                         | 5.0   | 4.67  | 5.31  |
| Food, storage and warehousing       | 14.06   | 12.43  | 9.15   | 11.98  | 8.42                         | 13.69 | –     | 14.14 |
| Agricultural research and education | 5.48    | 5.77   | 9.23   | 6.92   | 8.2                          | 7.35  | 6.99  | 7.31  |
| Cooperation                         | 8.46    | 10.67  | 9.53   | 9.63   | 14.91                        | 13.66 | 9.72  | 12.58 |
| Others                              | 1.11    | 0.52   | 1.18   | 0.94   | –                            | 10.24 | 7.2   | 9.89  |
| <b>Irrigation (Rs. billion)</b>     | 129.36  | 188.93 | 157.17 | 477.79 | 8.18                         | 8.14  | 4.76  | 6.91  |
| <b>% share of</b>                   | 100     | 100    | 100    | 100    |                              |       |       |       |
| Minor                               | 27.68   | 4.81   | 16.64  | 19.15  | 11.95                        | 9.17  | 9.58  | 10.32 |
| Medium–major                        | 56.29   | 31.2   | 76.77  | 71.76  | 5.75                         | 8.11  | 3.73  | 5.89  |
| Command area dev.                   | 2.53    | 1.2    | 1.3    | 1.83   | 7.5                          | 2.41  | 2.15  | 4.32  |
| Flood control                       | 13.5    | 62.8   | 5.29   | 7.25   | 15.86                        | 8.38  | 12.88 | 12.71 |

Source Bathla et al. (2017)

**Table 2.3** Expenditure on agriculture and irrigation and GSDPA per ha (Rs. at 2004–05 price)

|                | Agriculture R&D |         | Irrigation |         | Private investment agriculture |         | GSDPA/ha |         |
|----------------|-----------------|---------|------------|---------|--------------------------------|---------|----------|---------|
|                | TE 1984         | TE 2014 | TE 1984    | TE 2014 | 1981–82                        | 2012–13 | TE 1984  | TE 2014 |
| Andhra Pradesh | 164             | 1838    | 1376       | 10,106  | 604                            | 1250    | 29,036   | 73,554  |
| Assam          | 574             | 2183    | 686        | 2128    | 257                            | 512     | 39,650   | 64,126  |
| Bihar          | 240             | 2432    | 1347       | 3071    | 237                            | 540     | 24,879   | 77,697  |
| Gujarat        | 191             | 1620    | 1332       | 4561    | 468                            | 1762    | 22,181   | 46,279  |
| Haryana        | 286             | 1281    | 1481       | 2910    | 961                            | 1611    | 29,855   | 84,905  |
| Himachal Pr    | 2043            | 5351    | 803        | 5626    | 663                            | 7772    | 52,546   | 146,581 |
| J&K            | 780             | 4969    | 1959       | 4646    | 550                            | 2273    | 55,462   | 100,751 |

(continued)

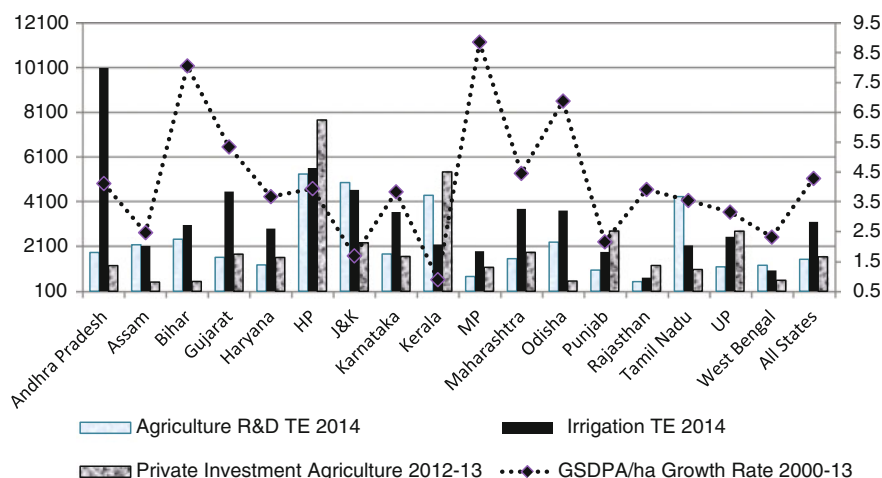
**Table 2.3** (continued)

|              | Agriculture R&D |         | Irrigation |         | Private investment agriculture |         | GSDPA/ha |         |
|--------------|-----------------|---------|------------|---------|--------------------------------|---------|----------|---------|
|              | TE 1984         | TE 2014 | TE 1984    | TE 2014 | 1981–82                        | 2012–13 | TE 1984  | TE 2014 |
| Karnataka    | 161             | 1770    | 920        | 3646    | 406                            | 1659    | 19,083   | 44,632  |
| Kerala       | 706             | 4398    | 1600       | 2193    | 1147                           | 5447    | 51,187   | 99,014  |
| Madhya Pr    | 138             | 762     | 615        | 1891    | 224                            | 1173    | 9329     | 37,312  |
| Maharashtra  | 211             | 1560    | 1093       | 3790    | 399                            | 1843    | 11,219   | 38,100  |
| Odisha       | 260             | 2301    | 1222       | 3719    | 120                            | 558     | 25,778   | 55,511  |
| Punjab       | 318             | 1049    | 1082       | 1868    | 1602                           | 2799    | 36,762   | 87,533  |
| Rajasthan    | 61              | 532     | 553        | 714     | 282                            | 1256    | 10,327   | 27,969  |
| Tamil Nadu   | 572             | 4341    | 729        | 2150    | 745                            | 1076    | 25,486   | 69,263  |
| Uttar Pr     | 182             | 1195    | 1265       | 2537    | 684                            | 2791    | 27,043   | 61,590  |
| West Bengal  | 297             | 1264    | 596        | 1037    | 253                            | 593     | 34,956   | 109,749 |
| Total States | 222             | 1532    | 1012       | 3206    | 471                            | 1645    | 20,956   | 54,827  |

*Note* Public expenditure is on revenue and capital accounts. Irrigation head excludes expenditure on flood control; Private investment relates to 1981–82 and 2012–13 when All India Debt and Investment Survey (AIDIS) was done

*Source* Finance accounts, Government of India, various issues

productivity and growth. The estimates show a sizeable increase in spending on these heads in each state. At the national level, a seven times increase in public expenditure on agriculture R&D and three times increase in irrigation has taken place from TE 1984–85 to TE 2014–15, the absolute amount being Rs. 1532/ha to Rs. 3206/ha. Large interstate differentials in spending on agriculture R&D are perceptible, the highest in Himachal Pradesh and J&K at Rs. 5351 and Rs. 4968 and lowest at Rs. 532/ha in Rajasthan. One state viz. Andhra Pradesh spends the maximum amount on irrigation (Rs. 10,106/ha), while Rajasthan a rainfall scant state spends the least at Rs. 714/ha. Clearly, the developed states spent more which is obvious due to higher economic growth in these states and hence better spending power. One may see that agricultural R&D expenditure is high in the poor and rich states, at more than Rs. 2300/ha, respectively, compared to nearly Rs. 1500 among the middle-income states. The states that have low average per ha public investment in the recent period include Assam, Bihar, Kerala, Madhya Pradesh, Odisha, Punjab, Rajasthan, Tamil Nadu, Uttar Pradesh and West Bengal. Similar to public spending, private investment has also increased significantly from Rs. 471/ha in 1981–82 to Rs. 1645/ha in 2012–13. In case of private investment, Gujarat, Haryana, Himachal Pradesh, Jammu & Kashmir, Karnataka, Kerala, Maharashtra and Punjab have made significant strides, perhaps due to better banking infrastructure and opportunities. Barring UP, the less developed states continue to lag behind, which indicates a strong need to increase the flow of credit to these states.



**Fig. 2.2** Per ha public expenditure and private investment on agriculture and annual rate of growth in GSDPA (2000–13). *Source* Finance accounts (various years) AIDIS and NAS

Similar to investments, the interstate heterogeneity is perceptible in gross income from agriculture and allied activities. The per ha GSDPA has significantly increased from Rs. 20,956 during TE 1984–85 to Rs. 54,827 during TE 2014–15 by 3.1% per annum during 1981–82 to 2014–15. The states where agriculture growth is above national average include Andhra Pradesh, Madhya Pradesh, Himachal Pradesh, Haryana, Rajasthan, Maharashtra and West Bengal. Among other states, Assam, Odisha and Uttar Pradesh lagged behind slightly. However, over the past decade, many less developed states have surpassed the national average rate of growth in income. As depicted in Fig. 2.2, agriculture income in Bihar, Madhya Pradesh and Odisha have grown to almost 9% per annum from 2000–01 to 2013–14. Compared to the 1990s, the agricultural growth has undoubtedly picked in each state to reach close to 3.5% per annum. Perhaps, low capital intensity in public expenditure partly explains a slow pace of agricultural growth in some states. To what extent can an increase in agriculture income be attributed to higher public spending on agriculture and irrigation? The following section provides empirical findings of this relationship.

### 2.3 Empirical Estimates on Impact of Public Expenditure on Agriculture Growth

The analysis is undertaken from 1981 to 2013 based on OLS and GMM models using the double-log functional form. The regression results presented in Table 2.4 show that the dependent variable GSDPA is positively affected by the key explanatory variables, viz. public expenditure on agriculture R&D and irrigation. Taking state fixed effects and time into consideration, the estimated coefficient of R&D (0.016) is positive but statistically insignificant and that on public irrigation (0.12) is significant at 1% level. It indicates that a 10% increasing in government

**Table 2.4** Empirical estimates from 1981 to 2013 at constant (2004–05) prices

| Dependent variable                | Log GSDP agriculture per capita |                        |
|-----------------------------------|---------------------------------|------------------------|
| Independent variables:            | <b>OLS</b>                      | <b>Difference GMM</b>  |
| Lagged GSDPA/capita               | 0.48* (0.058)                   | 0.51* (0.069)          |
| Public exp. agriculture R&D/ha    | 0.016 (0.017)                   | 0.05* (0.19)           |
| –Lagged                           | –                               | –0.026 (0.024)         |
| Public exp. irrigation/ha         | 0.12* (0.018)                   | –0.084 (0.11)          |
| –Lagged                           | –                               | 0.19*** (0.11)         |
| Private investment agriculture/ha | –0.20* (0.084)                  | –0.13*** (0.08)        |
| –Lagged                           | 0.21* (0.084)                   | 0.12*** (0.07)         |
| GSDP non-agriculture/capita       | 0.082* (0.027)                  | 0.34** (0.17)          |
| –Lagged                           | –                               | –0.29*** (0.17)        |
| Land (GCA)                        | 0.37* (0.068)                   | 0.35* (0.085)          |
| Labour/ha                         | 0.041*** (0.024)                | 0.038** (0.02)         |
| Rainfall                          | 0.052* (0.02)                   | 0.05*** (0.03)         |
| Constant                          | –0.91 (0.89)                    |                        |
| State fixed effects               | Yes                             | Yes                    |
| Year effects                      | Yes                             | Yes                    |
| Adjusted $R^2$                    | 0.94                            | –                      |
| Hansen test $P$ -value            | –                               | Prob > chi2 = 1.000    |
| Sargan test                       | –                               | Prob > chi2 = 0.359    |
| AR1 test $P$ -value               | –                               | –2.80 Pr > $z$ = 0.005 |
| AR2 test $P$ -value               | –                               | 2.12 Pr > $z$ = 0.034  |
| No. of states                     | 17                              | 17                     |
| No. of observations               | 544                             | 527                    |

*Note* Variables specified in log. \*, \*\* and \*\*\* denote statistical significance at 1, 5 and 10% level, respectively

Figures in parentheses are standard errors. Public expenditure on irrigation excludes flood control. Public expenditure on agriculture and irrigation are capital stocks

spending on irrigation can increase agriculture income by 1.2%. The positive signs of coefficients also suggest that composition of spending matters as R&D head is broadened to include soil conservation and crop and animal husbandry, whereas irrigation is condensed to take minor–medium–major command area development and exclude flood control. Besides public investment, income is also influenced by lagged private investment with a much higher elasticity at 0.21. Among land, labour and weather variables, the most important turns out to be land having the highest elasticity at 0.37. Non-agriculture income also stands important in raising agriculture income (elasticity 0.082). These factors together explain nearly 94% of the variations in agriculture income as indicated by adjusted  $R^2$ . The impact of economic reforms captured through a dummy (1 from 1991 to 0 otherwise) turned out to be insignificant and hence dropped from the equation.

Estimated results from GMM specification confirm that agricultural income is positively and significantly determined by all the explanatory variables. One to two

periods lagged levels of each variable are used as instruments in the difference equation. A few diagnostic tests are done to check the robustness of the estimates. The Hansen's test for over identifying restrictions as well as the AR test for no second-order serial correlation are passed at 1% level of significance. Sargan test was performed for over-identification of the equation, and test results show it to be identified. The estimated coefficients on land, labour and weather remained unchanged, whereas the value of key variables differ from that obtained in the OLS specification.

Public spending on agriculture R&D turns out to be significant in raising income under GMM (elasticity 0.05) as compared to the OLS. The elasticity of irrigation is also higher at 0.19. Similarly, non-agriculture income shows a higher magnitude of effect on agriculture income in the GMM specification. Importantly, in both OLS and GMM, the value of lagged dependent variable is not close to one, which indicates erratic changes in agriculture income across the states, possibly due to high dependence on weather conditions and state-specific policy interventions. The analysis substantiates the literature available at the national level in India and in some developing economies on a significant and positive relationship between public investment and agriculture income (Armas et al. 2012; Fan and Rao 2008). Similar to the Indonesian study, it also points towards the significance of composition of public spending within the agricultural sector in India.

## 2.4 Conclusion

The main objective of this chapter is to empirically examine the relationship between public investments in agriculture and irrigation and income in the Indian context. The analysis is based on a time series of public expenditures on agriculture R&D and irrigation for 17 major states from 1981–81 to 2013–14 using OLS and GMM techniques. The analysis reveals that low and inadequate public capital formation during the nineties impinged upon farmers' investments and jeopardized technological change and agricultural growth. A big push in resource allocation towards agriculture and irrigation from 2003–04 is an important policy initiative. Significant increase in expenditure on irrigation system in the less developed states has helped to turn around deceleration in productivity growth and upturn private investment and income.

Large interstate variations in public spending on agriculture and irrigation continue, showing richer (developed) states tend to spend more compared to the poorer (less developed) agriculturally dependent states, barring Himachal Pradesh and Jammu & Kashmir. Notwithstanding such interstate disparities in spending on agriculture and irrigation, the empirical analysis reveals their positive and significant impact on agriculture income. Both OLS and GMM approaches show consistent results. However, GMM specification shows the estimated coefficient on public spending on agriculture R&D and irrigation to be much higher at 0.05 and 0.19, respectively, in impacting agriculture income. It also brings forth the



importance of composition of public spending in agriculture. The study points towards an urgent need to accord due priority to the agricultural sector in the fiscal policy. It recommends an increased resource allocation to the poorer states and capital deepening for accelerating farm productivity and income.

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# Chapter 3

## Dynamics of Access to Rural Credit in India: Patterns, Determinants and Implications

Anjani Kumar

### 3.1 Introduction

Credit has been conceived to play a crucial role in fostering rural development in India. Since long, policymakers have been expressing concern for transforming the credit delivery mechanism to enhance the rural households' access to institutional credit. The first state intervention in rural financial markets was motivated by the findings of the India Rural Credit Survey (Gorwala Committee 1954) which showed that institutional credit<sup>1</sup> accounted for only 7% of the borrowings of rural households in 1951–52 (Mahajan and Ramola 1996). Since then, several initiatives have been taken to strengthen the mechanisms for institutional credit delivery system.

The major milestones in improving rural credit include acceptance of Rural Credit Survey Committee Report (1954), nationalization of major commercial banks (1969 and 1980), establishment of regional rural banks (RRBs) (1975), establishment of National Bank for Agriculture and Rural Development (NABARD) (1982), the financial sector reforms (1991 onwards), Special Agricultural Credit Plan (1994–95), launching of Kisan credit cards (KCCs) (1998–99), Doubling Agricultural Credit within 3 years (2004), Agricultural Debt Waiver and Debt Relief Scheme (2008), and

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<sup>1</sup>The public sector banks, cooperative society banks, commercial banks and regional rural banks are the major institutional sources of credit.

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the Jan Dhan Yojana (2014) (Kumar et al. 2010; Economic Survey 2014–2015). Simultaneously, several other measures such as establishment of Lead Bank Scheme, direct lending for the priority sectors, banking sector's linkage with the government-sponsored programmes targeted at the poor, Differential Rate of Interest Scheme, the Service Area Approach, the SHG–Bank linkage programme, Special Agricultural Credit Plans and rural infrastructure development fund (RIDF) schemes were introduced to enhance the flow of credit to the rural sector. These initiatives have had a positive impact on the flow of rural credit. However, the inadequacy of rural credit especially to agriculture continues to remain a big challenge. The persistence of moneylenders in the rural credit market is also often fiercely debated in the policy discourses in India. But, most of the discussions on the issue of rural credit are, by and large, swayed by perceptions and empirical validation of the changes taking place in the rural credit market is often lacking. Also, empirical studies on the characteristics of borrowers from institutional sources are few and the factors which determine the choice of credit sources have not received much attention amongst the academia and policymakers. An empirical analysis of rural credit delivery at the micro-level and determinants for access to institutional credit would be useful in understanding the behaviour of borrowers. This will also help in reorienting the credit policies and programmes for a better credit flow.

In this backdrop, the present study was undertaken to analyse (1) changes in the structure of rural credit delivery system, (2) inclusiveness of rural credit flow across states and social groups and (3) factors that influence the choice of credit source.

## 3.2 Data and Methodology

The study is based on the unit-level data of Debt and Investment Surveys carried out by National Sample Survey Organisation (NSSO) during 1992 (48th round), 2003 (59th round), 2013 (70th round) and the Situation Assessment Survey of Agricultural Households carried out in 2013. The Debt and Investment survey, generally carried out once in 10 years, provides information on different dimensions of rural finance. These surveys are undertaken pan India, and adequate number of samples from each are included to represent a particular state. The survey also provides information on several household characteristics such as ownership of assets, social and demographic variables, households' association with networks such as self-help groups, cooperatives, etc. Further, this data set enables analysis from the borrowers' side and therefore this information is more reliable. The structure of credit system has been assessed in terms of access of rural households to different credit outlets, share of formal credit institutions, availability of credit and interest rate. The determinants of agricultural households' access to institutional credit and its impact on farm households' economic welfare have been analysed by using 70th round NSSO data on Situation Assessment of Agricultural Households.

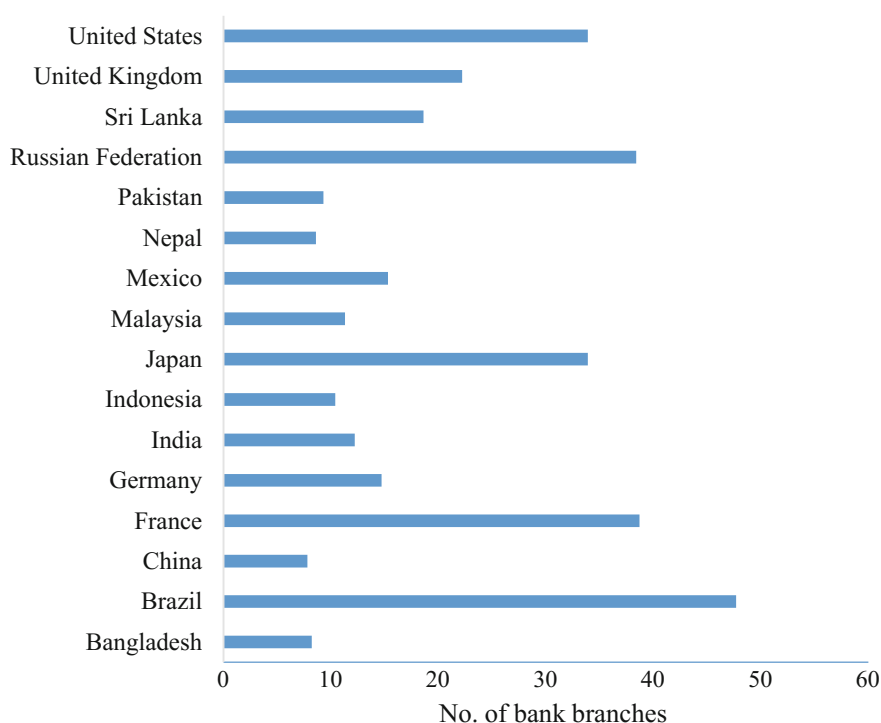
A two-step analysis was conducted to explain the rural households' decision to borrow and their access to institutional credit. These steps included a simple probit to assess the households' decision to borrow, followed by application of McFadden's choice model, using conditional probit model. Mills ratios for the decision to borrow were then computed and introduced as additional explanatory variables into the next step to assess the choice of credit sources.

### 3.3 Results and Discussions

#### 3.3.1 *Structure of Rural Credit Markets*

India has a vast network of financial institutions to lend rural credit. The 1970s and 1980s witnessed a rapid expansion of India's financial system in the rural areas. Following nationalization of major banks in 1969, the commercial banks (CBs) were mandated to open rural branches. The number of rural branches increased from 1833 in 1969 to 30,186 in 1985; it continued to expand (except during the 1990s) and today, India has about 47,000 rural branches of commercial banks and regional rural banks, besides branches of cooperative banks and primary cooperative societies. Due to this vast expansion of rural banks network, India compares favourably with other developing countries in terms of banking infrastructure. The average population served per commercial bank branch is lower in India compared to China, but higher as compared to most of the developed countries (Fig. 3.1). However, the physical availability of bank branches has been improving overtime.

The existence of an informal credit market alongside a formal institutional credit market has been recognized as a key feature of rural credit market in developing countries and attracted continuous attention in the literature of development economies (Guirkinger 2008; Conning and Udry 2007; Hoff and Stieglitz 1990). In India, considerable efforts were made to enhance the flow of institutional credit in rural areas since Independence. These efforts have enhanced the share of institutional sources of credit from 9% in 1951 to 56% in 1992 (Kumar et al. 2007). During the 1990s, several measures were taken to liberalize the Indian economy and reforms were also initiated in the financial sector. The main focus of financial sector reforms was on restoring profitability of banks and ensuring implementation of prudential norms. The financial sector reforms, however, decelerated the growth of agricultural credit, and the share of institutional credit increased only marginally to 57% in 2003 at the national level (Table 3.1). This alarmed policymakers, and in 2004, the Government of India embarked on an ambitious plan of doubling the agricultural credit in 3 years. Since then, the flow of credit to rural areas has been increasing and in 2013, the share of institutional credit rose to 61% (Fig. 3.2). However, the informal credit, which is often exploitative, still persists and its



**Fig. 3.1** Number of bank branches per 100,000 adult population in different countries. *Source* World development indicators 2015. World Bank, Washington, D.C.

persistence in spite of vigorous efforts to promote financial inclusion is puzzling. The persistence of informal credit<sup>2</sup> has serious implications and raises many questions on the functioning of institutional credit mechanism.

The borrowing in absolute terms by rural households has increased from “₹” 980 in 1992 to “₹” 4850 in 2013, more than five times, registering an annual growth rate of 7.5, which per cent is quite significant. However, the trends and patterns of growth in credit are not uniform across the states and the interstate variations in disbursement and growth of credit are glaring. The share of institutional credit in the rural areas has increased enormously in several states, but in some states such as Andhra Pradesh, Bihar, Jharkhand, Manipur and Rajasthan, it continues to be low and was less than 50% in 2013 (Table 3.1).

In majority of the states, the share of institutional credit accounted for 50–75% in 1992 and 2013. A few states—Kerala, Meghalaya, Arunachal Pradesh, Uttarakhand, Himachal Pradesh, Mizoram and Sikkim—registered an impressive

<sup>2</sup>Private moneylenders, large landowners, traders, relatives and friends constitute the informal or non-institutional sources of credit.

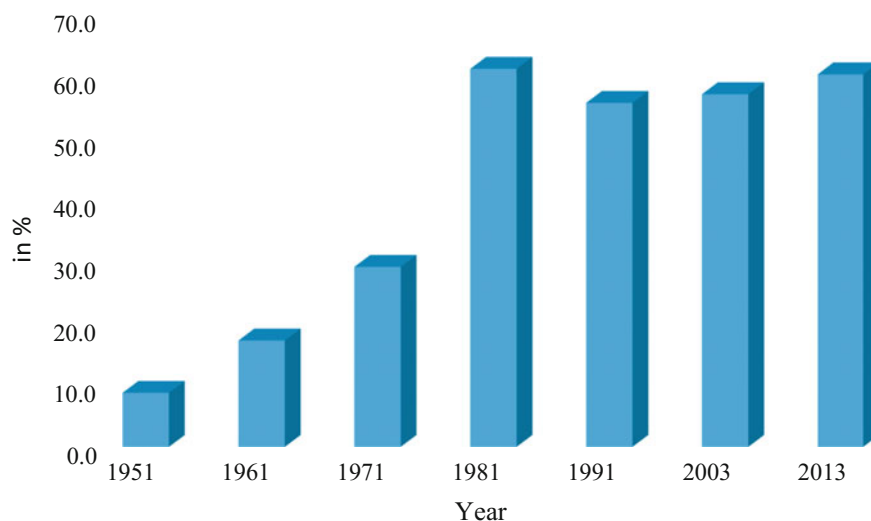
**Table 3.1** Amount and share of institutional borrowings in different states of India: 1992, 2003 and 2013

| State             | Average amount of borrowing<br>(‘₹’/ha at 1993–94 prices) |        |        | Share of institutional credit<br>(%) |      |      |
|-------------------|-----------------------------------------------------------|--------|--------|--------------------------------------|------|------|
|                   | 1992                                                      | 2003   | 2013   | 1992                                 | 2003 | 2013 |
| Andhra Pradesh    | 1970                                                      | 6448   | 6801   | 25.6                                 | 37.5 | 41.6 |
| Arunachal Pradesh | 143                                                       | 90     | 554    | 56.5                                 | 78.4 | 80.0 |
| Assam             | 330                                                       | 723    | 1001   | 45.0                                 | 46.4 | 71.5 |
| Bihar             | 536                                                       | 1646   | 4710   | 51.2                                 | 23.5 | 28.9 |
| Chhattisgarh      | 299                                                       | 864    | 1199   | 74.4                                 | 57.3 | 64.6 |
| Gujarat           | 780                                                       | 2608   | 2380   | 74.7                                 | 75.7 | 65.2 |
| Haryana           | 1097                                                      | 6974   | 4181   | 52.7                                 | 61.8 | 61.0 |
| Himachal Pradesh  | 1859                                                      | 4591   | 10,765 | 60.3                                 | 57.2 | 85.2 |
| Jammu & Kashmir   | 692                                                       | 1326   | 4147   | 42.8                                 | 82.7 | 72.5 |
| Jharkhand         | 215                                                       | 1769   | 1542   | 94.4                                 | 90.9 | 44.9 |
| Karnataka         | 740                                                       | 2907   | 5378   | 62.8                                 | 62.5 | 53.6 |
| Kerala            | 5893                                                      | 35,857 | 76,421 | 81.8                                 | 81.6 | 79.2 |
| Madhya Pradesh    | 564                                                       | 1662   | 1872   | 57.8                                 | 62.3 | 62.0 |
| Maharashtra       | 936                                                       | 2347   | 2890   | 77.1                                 | 78.1 | 71.5 |
| Manipur           | 224                                                       | 1426   | 827    | 53.2                                 | 7.8  | 33.7 |
| Meghalaya         | 49                                                        | 185    | 397    | 91.9                                 | 38.1 | 79.7 |
| Mizoram           | 144                                                       | 334    | 734    | 68.2                                 | 84.5 | 92.0 |
| Nagaland          | 225                                                       | 1278   | 551    | 72.8                                 | 71.3 | 65.3 |
| Odisha            | 298                                                       | 1784   | 2542   | 70.2                                 | 69.3 | 63.0 |
| Punjab            | 2359                                                      | 10,179 | 8718   | 59.3                                 | 53.8 | 62.1 |
| Rajasthan         | 550                                                       | 1247   | 3137   | 30.3                                 | 38.7 | 46.1 |
| Sikkim            | 395                                                       | 2117   | 6309   | 98.6                                 | 75.8 | 96.1 |
| Tamil Nadu        | 3857                                                      | 14,987 | 16,638 | 61.9                                 | 46.6 | 62.2 |
| Tripura           | 1066                                                      | 3308   | 2290   | 84.0                                 | 74.0 | 61.6 |
| Uttar Pradesh     | 721                                                       | 2171   | 3814   | 54.8                                 | 53.6 | 60.7 |
| Uttarakhand       | 1924                                                      | 1315   | 8881   | 29.0                                 | 53.9 | 80.0 |
| West Bengal       | 1155                                                      | 3072   | 6373   | 55.5                                 | 48.6 | 51.5 |
| India             | 980                                                       | 3356   | 4850   | 55.7                                 | 57.1 | 60.3 |

*Data source* Unit-level data on debt and investment surveys, 48th (1992), 59th (2003) and 70th (2013) rounds. National Sample Survey Organization, New Delhi

performance and institutional credit accounted for more than 75% of the total rural credit. More details on borrowing from institutional and non-institutional system are given in Annexure Tables 3.10 and 3.11.

Between 1992 and 2013, the compound annual growth rates of institutional rural credit varied from 2.1% in Tripura to 13.3% in Sikkim. The other states which registered double-digit growth included Uttarakhand (12.3%), Madhya Pradesh (12.2%), Jammu & Kashmir (11.1%), Rajasthan (10.3%) and Himachal Pradesh



**Fig. 3.2** Share of institutional credit in rural borrowings in India, 1951–2013. *Source* India rural credit survey, RBI; India debt and investment surveys, NSSO

(10.0%). The growth in non-institutional rural credit varied from 11.2% in Uttarakhand to 21.4% in Jharkhand. The other states which recorded more than 10% growth in credit from non-institutional sources were Bihar (12.3%), Karnataka (10.5%), Kerala (13.0%), Meghalaya (14.6%), Odisha (11.3%) and Sikkim (18.4%) (Table 3.2).

**Table 3.2** Compound annual growth rates of institutional and non-institutional borrowings: 1992–2013

| State             | CAGR (%) in credit/ha |                   |       | CAGR (%) in credit/capita |                   |       |
|-------------------|-----------------------|-------------------|-------|---------------------------|-------------------|-------|
|                   | Institutional         | Non-institutional | Total | Institutional             | Non-institutional | Total |
| Andhra Pradesh    | 8.2                   | 4.6               | 5.8   | 8.2                       | 4.7               | 5.9   |
| Arunachal Pradesh | 8.0                   | 2.7               | 6.4   | 8.8                       | 3.8               | 7.3   |
| Assam             | 7.4                   | 2.1               | 5.2   | 7.1                       | 1.7               | 4.8   |
| Bihar             | 7.5                   | 12.3              | 10.4  | 4.3                       | 8.8               | 7.0   |
| Chhattisgarh      | 5.8                   | 8.1               | 6.5   | 3.1                       | 5.4               | 3.8   |
| Gujarat           | 4.6                   | 6.8               | 5.2   | 3.6                       | 5.8               | 4.2   |
| Haryana           | 7.0                   | 5.3               | 6.3   | 4.2                       | 2.6               | 3.5   |
| Himachal Pradesh  | 10.0                  | 3.6               | 8.3   | 8.4                       | 2.0               | 6.7   |

(continued)



**Table 3.2** (continued)

| State                        | CAGR (%) in credit/ha |                   |       | CAGR (%) in credit/capita |                   |       |
|------------------------------|-----------------------|-------------------|-------|---------------------------|-------------------|-------|
|                              | Institutional         | Non-institutional | Total | Institutional             | Non-institutional | Total |
| Jammu & Kashmir              | 11.1                  | 4.9               | 8.5   | 7.8                       | 1.8               | 5.3   |
| Jharkhand                    | 5.7                   | 21.4              | 9.4   | 2.5                       | 17.0              | 6.0   |
| Karnataka                    | 8.7                   | 10.5              | 9.4   | 7.1                       | 9.0               | 7.9   |
| Kerala                       | 12.2                  | 13.0              | 12.4  | 10.3                      | 11.2              | 10.5  |
| Madhya Pradesh               | 5.9                   | 5.1               | 5.6   | 4.1                       | 3.3               | 3.8   |
| Maharashtra                  | 4.9                   | 6.3               | 5.3   | 3.8                       | 5.2               | 4.1   |
| Manipur                      | 3.9                   | 7.8               | 6.1   | 3.8                       | 7.5               | 5.9   |
| Meghalaya                    | 9.3                   | 14.6              | 10.0  | 8.4                       | 10.5              | 8.7   |
| Mizoram                      | 9.2                   | 1.1               | 7.7   | 9.2                       | 1.4               | 7.8   |
| Nagaland                     | 3.6                   | 5.3               | 4.2   | 2.9                       | 4.7               | 3.3   |
| Odisha                       | 9.7                   | 11.3              | 10.2  | 7.5                       | 9.0               | 8.0   |
| Punjab                       | 6.4                   | 5.8               | 6.1   | 5.7                       | 5.1               | 5.5   |
| Rajasthan                    | 10.3                  | 7.0               | 8.2   | 8.0                       | 4.7               | 5.9   |
| Sikkim                       | 13.3                  | 18.4              | 13.4  | 9.8                       | 15.5              | 9.8   |
| Tamil Nadu                   | 6.9                   | 6.8               | 6.9   | 5.8                       | 5.7               | 5.8   |
| Tripura                      | 2.1                   | 7.8               | 3.5   | 2.3                       | 8.2               | 3.8   |
| Uttar Pradesh                | 8.4                   | 7.2               | 7.9   | 5.7                       | 4.6               | 5.2   |
| Uttarakhand                  | 12.3                  | 1.2               | 7.2   | 10.5                      | -0.4              | 5.5   |
| West Bengal                  | 7.7                   | 8.5               | 8.1   | 4.4                       | 5.2               | 4.8   |
| India                        | 7.9                   | 7.0               | 7.5   | 6.1                       | 5.2               | 5.7   |
| Coefficient of variation (%) | 34.9                  | 62.1              | 30.9  | 40.6                      | 66.7              | 31.6  |

*Data source* Unit-level data on debt and investment surveys, 48th (1992), 59th (2003) and 70th (2013) rounds. National Sample Survey Organization, New Delhi

### 3.3.2 Financial Inclusion

Financial inclusion is a prerequisite to promote inclusive and sustainable growth. India's record even after six decades of efforts to promote financial inclusion is not very impressive; it has 104th position in the ranking of 176 countries. Though financial inclusion can be measured in several ways, different indicators can be estimated to assess the status of inclusiveness of institutional rural credit system. Here, we have analysed the inclusiveness of the institutional credit in terms of participation of smallholders and socially disadvantaged groups in the flow of institutional credit to the rural area.

There is a predominance of landless, marginal and smallholders in rural households in India. In 2013, they together accounted for about 93% of the total rural households (Table 3.3). The ratio of their share in institutional credit and households has increased from 0.72 in 2003 to 0.84 in 2013, indicating a trend

**Table 3.3** Share of landless, marginal and smallholders in total households and credit, 2003 and 2013

| States            | Share in households (%) |      | Share in institutional credit (%) |      | Ratio of shares in institutional credit and households |      |
|-------------------|-------------------------|------|-----------------------------------|------|--------------------------------------------------------|------|
|                   | 2003                    | 2013 | 2003                              | 2013 | 2003                                                   | 2013 |
| Andhra Pradesh    | 93.5                    | 88.8 | 71.1                              | 72.7 | 0.76                                                   | 0.82 |
| Arunachal Pradesh | 87.2                    | 91.5 | 80.2                              | 77.4 | 0.92                                                   | 0.85 |
| Assam             | 96.2                    | 95.8 | 85.8                              | 88.8 | 0.89                                                   | 0.93 |
| Bihar             | 97.2                    | 98.7 | 69.4                              | 89.2 | 0.71                                                   | 0.90 |
| Chhattisgarh      | 83.3                    | 90.5 | 44.0                              | 71.5 | 0.53                                                   | 0.79 |
| Gujarat           | 84.9                    | 79.3 | 49.1                              | 54.4 | 0.58                                                   | 0.69 |
| Haryana           | 86.3                    | 82.3 | 59.3                              | 56.8 | 0.69                                                   | 0.69 |
| Himachal Pradesh  | 96.5                    | 98.3 | 90.7                              | 97.7 | 0.94                                                   | 0.99 |
| Jammu & Kashmir   | 93.1                    | 97.0 | 70.1                              | 95.4 | 0.75                                                   | 0.98 |
| Jharkhand         | 97.7                    | 99.2 | 96.1                              | 95.8 | 0.98                                                   | 0.97 |
| Karnataka         | 87.5                    | 87.2 | 54.5                              | 71.1 | 0.62                                                   | 0.82 |
| Kerala            | 99.1                    | 99.5 | 93.7                              | 97.5 | 0.94                                                   | 0.98 |
| Madhya Pradesh    | 81.1                    | 78.3 | 37.6                              | 33.4 | 0.46                                                   | 0.43 |
| Maharashtra       | 84.5                    | 78.1 | 58.5                              | 59.0 | 0.69                                                   | 0.76 |
| Manipur           | 98.7                    | 98.7 | 99.1                              | 97.9 | 1.00                                                   | 0.99 |
| Meghalaya         | 93.3                    | 97.6 | 80.1                              | 97.6 | 0.86                                                   | 1.00 |
| Mizoram           | 93.0                    | 92.0 | 91.1                              | 87.8 | 0.98                                                   | 0.95 |
| Nagaland          | 98.8                    | 98.9 | 84.9                              | 86.9 | 0.86                                                   | 0.88 |
| Odisha            | 95.7                    | 97.3 | 89.2                              | 94.0 | 0.93                                                   | 0.97 |
| Punjab            | 86.7                    | 83.7 | 38.7                              | 35.0 | 0.45                                                   | 0.42 |
| Rajasthan         | 77.8                    | 79.6 | 47.0                              | 56.5 | 0.60                                                   | 0.71 |
| Sikkim            | 97.4                    | 97.6 | 99.5                              | 97.0 | 1.02                                                   | 0.99 |
| Tamil Nadu        | 96.5                    | 97.8 | 79.4                              | 94.5 | 0.82                                                   | 0.97 |
| Tripura           | 99.8                    | 99.8 | 97.5                              | 99.7 | 0.98                                                   | 1.00 |
| Uttar Pradesh     | 93.6                    | 94.8 | 66.6                              | 77.4 | 0.71                                                   | 0.82 |
| Uttarakhand       | 96.6                    | 97.8 | 85.1                              | 94.8 | 0.88                                                   | 0.97 |
| West Bengal       | 98.8                    | 99.7 | 97.7                              | 99.2 | 0.99                                                   | 0.99 |
| India             | 91.6                    | 92.9 | 65.7                              | 76.7 | 0.72                                                   | 0.84 |

*Data source* Unit-level data on debt and investment surveys, 59th (2003) and 70th (2013) rounds. National Sample Survey Organization, New Delhi

towards equity in the disbursement of institutional credit. The institutional credit mechanism in rural areas seems to have been promoting equity and encouraging smallholders' access to formal credit. The ratio of their share in credit and population shows that the disbursement of rural credit has become more equitable in most of the states. The performance of Bihar, Chhattisgarh, Uttarakhand, Gujarat

and Jammu & Kashmir has been noteworthy in this regard. However, the small-holders' access to institutional credit has deteriorated in a few states such as Arunachal Pradesh and Madhya Pradesh during 2002–2013.

The social group identity is intricately related with economic outcomes in developing countries like India. In rural India, the historically entrenched caste system has significant influence on the economic status of people of different strata. Another dimension of financial inclusion is the participation of weaker sections of society in the institutional rural credit as there is still a high correlation between caste and socio-economic status in India. Recognizing the caste-based socio-economic disadvantages as a major constraint, the government policies are designed to alleviate this by providing a level playing field in several areas.

To promote financial inclusiveness in the rural areas, the first India Rural Credit Survey Committee Report recognized the socio-economic status as a key factor to improve access to rural finance, and a slew of measures have been intended to enhance the share of vulnerable sections of society in the institutional credit. Though policy perspectives continue to emphasize improvement in the financial inclusion for the socially and economically disadvantaged sections of society, a key question is whether such discriminations have vanished or not? To seek answer to this question, we have first analysed the participation of different social groups in institutional credit vis-à-vis their share in population. Our results reveal that the participation of scheduled caste (SC) and scheduled tribe (ST) households is significantly lower than their population in most of the states. At India level, their participation is less than 50% of their share in population. The situation is relatively better in Madhya Pradesh and Punjab.

In the north-eastern states, the widespread inequity in distribution of rural credit may be attributed to the direct relationship between caste and assets including landholdings. Though there has been some improvement in their access to formal credit, the speed of improvement seems to be slow. The ratio of their share in credit and population has improved only from 0.44 in 2003 to 0.49 in 2013. Our finding is consistent with earlier studies. For instance, Kumar (2013) has observed that banks discriminate between borrowers on the basis of their caste in the provision of agricultural credit. Our results reveal that concerted efforts are still required to increase the access of SC and ST households to formal rural credit market (Table 3.4). The participation of other backward castes (OBCs) in formal credit market is consistent with their share in population, and they do not seem to be discriminated.

### 3.3.3 *Structure of Interest Rates*

The continuance of informal credit market in the rural areas is attributed to several factors that include minimal formalities, fast disbursement, geographical and personal proximity and flexibility in repayment. All these factors induce the rural

**Table 3.4** Equity in disbursement of institutional credit across social classes in India, 2003 and 2013

| State             | 2003                    |        |                   | 2013   |                         |        |
|-------------------|-------------------------|--------|-------------------|--------|-------------------------|--------|
|                   | % share of SC and ST in |        | % share of OBC in |        | % share of SC and ST in |        |
|                   | Population              | Credit | Population        | Credit | Population              | Credit |
| Andhra Pradesh    | 31.6                    | 17.0   | 47.5              | 41.8   | 37.6                    | 20.4   |
| Arunachal Pradesh | 86.1                    | 99.2   | 0.3               | 0.0    | 75.7                    | 80.4   |
| Assam             | 22.1                    | 24.0   | 23.2              | 17.1   | 24.9                    | 26.4   |
| Bihar             | 22.3                    | 10.5   | 58.7              | 43.6   | 21.5                    | 5.9    |
| Chhattisgarh      | 50.4                    | 35.5   | 42.8              | 54.8   | 49.7                    | 22.2   |
| Gujarat           | 31.3                    | 14.1   | 42.3              | 33.4   | 31.1                    | 16.4   |
| Haryana           | 26.6                    | 9.9    | 34.3              | 32.1   | 18.9                    | 5.4    |
| Himachal Pradesh  | 28.3                    | 20.5   | 18.6              | 20.7   | 37.8                    | 24.5   |
| Jammu & Kashmir   | 15.2                    | 11.8   | 13.1              | 1.1    | 24.4                    | 16.3   |
| Jharkhand         | 46.3                    | 20.1   | 42.9              | 61.9   | 52.0                    | 22.6   |
| Karnataka         | 27.7                    | 8.9    | 34.9              | 22.6   | 30.6                    | 19.6   |
| Kerala            | 13.1                    | 4.2    | 55.8              | 51.4   | 11.6                    | 13.3   |
| Madhya Pradesh    | 36.8                    | 17.0   | 42.5              | 47.8   | 49.2                    | 16.0   |
| Maharashtra       | 27.7                    | 12.2   | 34.1              | 31.0   | 26.7                    | 15.2   |
| Manipur           | 45.7                    | 34.2   | 36.5              | 45.6   | 55.8                    | 40.0   |
| Meghalaya         | 92.4                    | 93.2   | 0.3               | 0.9    | 95.3                    | 84.9   |
| Mizoram           | 98.8                    | 100.0  | 1.2               | 0.0    | 98.5                    | 100.0  |
| Nagaland          | 95.2                    | 99.6   | 0.4               | 0.0    | 98.8                    | 99.9   |
| Odisha            | 45.5                    | 22.7   | 39.0              | 39.5   | 45.8                    | 25.5   |
| Punjab            | 41.0                    | 7.9    | 15.1              | 5.6    | 44.5                    | 7.0    |
| Rajasthan         | 36.2                    | 27.0   | 46.2              | 57.7   | 41.7                    | 29.9   |
| Sikkim            | 33.5                    | 41.8   | 31.7              | 27.8   | 52.5                    | 79.2   |

(continued)

**Table 3.4** (continued)

| State         | 2003                    |        |                   |        | 2013                    |        |                   |        |
|---------------|-------------------------|--------|-------------------|--------|-------------------------|--------|-------------------|--------|
|               | % share of SC and ST in |        | % share of OBC in |        | % share of SC and ST in |        | % share of OBC in |        |
|               | Population              | Credit | Population        | Credit | Population              | Credit | Population        | Credit |
| Tamil Nadu    | 26.8                    | 9.2    | 71.4              | 87.2   | 30.0                    | 13.6   | 67.4              | 83.8   |
| Tripura       | 49.1                    | 48.3   | 20.2              | 25.9   | 58.4                    | 49.2   | 15.5              | 24.3   |
| Uttar Pradesh | 26.8                    | 17.4   | 53.3              | 45.4   | 27.2                    | 12.0   | 54.9              | 57.9   |
| Uttarakhand   | 29.9                    | 31.8   | 6.9               | 15.9   | 27.5                    | 7.3    | 10.9              | 10.7   |
| West Bengal   | 36.8                    | 28.3   | 5.4               | 6.1    | 34.5                    | 24.3   | 11.0              | 13.2   |
| India         | 31.1                    | 13.8   | 42.0              | 41.2   | 33.1                    | 16.2   | 43.6              | 49.1   |

*Data source* Unit-level data on debt and investment surveys, 59th (2003) and 70th (2013) rounds, National Sample Survey Organization, New Delhi

**Table 3.5** State-wise interest rate on institutional and non-institutional borrowings, 1992, 2003 and 2013

| State             | Interest rate (%/annum) |      |      |                           |      |      |
|-------------------|-------------------------|------|------|---------------------------|------|------|
|                   | Institutional sources   |      |      | Non-institutional sources |      |      |
|                   | 1992                    | 2003 | 2013 | 1992                      | 2003 | 2013 |
| Andhra Pradesh    | 13.4                    | 12.8 | 11.4 | 25.4                      | 30.9 | 23.8 |
| Arunachal Pradesh | 14.0                    | 5.8  | 8.9  | 0.0                       | 4.2  | 3.9  |
| Assam             | 7.3                     | 9.7  | 12.0 | 1.4                       | 10.5 | 19.5 |
| Bihar             | 11.3                    | 11.7 | 12.7 | 23.3                      | 36.0 | 46.7 |
| Chhattisgarh      | 12.2                    | 13.9 | 5.4  | 24.3                      | 27.4 | 13.6 |
| Gujarat           | 12.4                    | 12.7 | 7.8  | 6.5                       | 8.9  | 10.8 |
| Haryana           | 10.2                    | 13.5 | 8.7  | 24.5                      | 23.9 | 21.2 |
| Himachal Pradesh  | 9.3                     | 11.4 | 9.9  | 5.0                       | 3.5  | 1.1  |
| Jammu & Kashmir   | 8.7                     | 11.1 | 11.0 | 5.7                       | 0.1  | 0.4  |
| Jharkhand         | 7.2                     | 8.3  | 10.8 | 8.3                       | 18.9 | 21.4 |
| Karnataka         | 13.1                    | 14.3 | 13.1 | 18.3                      | 25.2 | 24.3 |
| Kerala            | 15.3                    | 13.2 | 12.6 | 21.3                      | 29.5 | 17.0 |
| Madhya Pradesh    | 12.1                    | 12.9 | 7.5  | 27.1                      | 29.6 | 27.3 |
| Maharashtra       | 13.8                    | 15.1 | 9.0  | 14.7                      | 24.8 | 12.5 |
| Manipur           | 3.7                     | 25.4 | 25.1 | 32.6                      | 51.2 | 39.6 |
| Meghalaya         | 12.6                    | 8.5  | 8.0  | 0.0                       | 4.1  | 4.2  |
| Mizoram           | 5.8                     | 9.5  | 10.1 | 0.0                       | 0.2  | 0.4  |
| Nagaland          | 9.2                     | 11.9 | 27.1 | 1.0                       | 7.9  | 15.2 |
| Odisha            | 11.6                    | 13.0 | 10.7 | 31.8                      | 41.7 | 27.5 |
| Punjab            | 11.6                    | 12.7 | 9.5  | 11.5                      | 18.2 | 12.8 |
| Rajasthan         | 12.5                    | 13.4 | 7.8  | 27.9                      | 22.7 | 22.7 |
| Sikkim            | 9.4                     | 9.9  | 11.4 | 0.0                       | 13.3 | 6.7  |
| Tamil Nadu        | 11.5                    | 15.5 | 14.2 | 34.3                      | 35.1 | 31.6 |
| Tripura           | 6.9                     | 8.6  | 11.8 | 3.9                       | 2.9  | 15.7 |
| Uttar Pradesh     | 12.9                    | 12.0 | 9.5  | 25.1                      | 26.3 | 23.7 |
| Uttarakhand       | 8.1                     | 11.9 | 10.3 | 2.3                       | 27.5 | 8.2  |
| West Bengal       | 10.2                    | 11.8 | 13.6 | 19.3                      | 23.9 | 22.6 |
| India             | 12.5                    | 13.4 | 11.1 | 24.2                      | 28.6 | 25.1 |

*Data Source* Unit-level data on debt and investment surveys: 48th (1992), 59th (2003) and 70th (2013) rounds. National Sample Survey Organization, New Delhi

households to borrow from informal sources. But, several studies have reported about charging of extremely high interest rates by the non-institutional sources.

The state-wise interest rates on institutional and non-institutional borrowings are reported for the years 1992, 2003 and 2013 in Table 3.5. On average, the annual interest rate on institutional credit in rural India was 12.5% in 1992 which increased to 13.4% in 2003, but declined to 11.1% in 2013, with some variations across states. Contrary to this, the average interest rates charged by the non-institutional

agencies varied from 24 to 28% during this period. Thus, the interest rates charged by non-institutional sources have been found to be more than two times between 1992 and 2013. Further, a wide variation is seen in the interest rates charged by non-institutional agencies across states. For instance, in 2013, the interest rate charged by non-institutional sources was the highest in Bihar (46.7%), followed by Manipur (39.6%), Odisha (27.5%), Madhya Pradesh (27.3%), Karnataka (24.3%), Andhra Pradesh (23.8%), Uttar Pradesh (23.7%), Sikkim (22.7%) and West Bengal (22.6%). In some states, the rate of interest is quite low too (Table 3.5).

The extensive rural credit programs which have been undertaken overtime were expected to break the monopoly power of informal lenders, and the interest rates charged by the informal lenders should have declined overtime. However, in spite of the whopping increase in the flow of institutional rural credit, the interest rates charged by the informal sources continued to be exploitative and have shown a stubborn tendency to persist.

The interest rates charged by the moneylenders further reveal the extent of exploitation in the rural credit market. The moneylenders are the major sources of informal credit and account for more than two-thirds of the non-institutional rural credit. The average interest charged by them is more than thrice (37.0%) the interest rate charged by institutional sources (11.0%).

The interest rate charged by the moneylenders varied across the states. In 2003, it varied from 1.2% in Jammu & Kashmir to 63% in Manipur and in 2013; it varied from 5.1% in Arunachal Pradesh to 60% in Bihar. In fact, in most of the states, the interest rate charged by the moneylenders was more than 30%. The expansion of formal rural credit market has not been able to contain the high interest rates of moneylenders (Table 3.6). The effective monthly interest rates charged by the moneylenders have been reported to vary from 5% to more than 100% by earlier studies too (Robinson 2001).

The high variance in the interest rates charged by the moneylenders may be attributed to the difference in the types of loan, risks in money lending and bargaining power of the borrowers. High transaction costs of lending, low lending volumes, high opportunity cost of capital and the absence of legal recourse for loan recovery were amongst the factors that induce the moneylender to keep the interest rates high. These high rates of interest have significant economic and social costs. They, in fact, inhibit the growth of borrowers' entrepreneurial ability and in some cases force them to become defaulters. The findings clearly exhibited that the interest charged by informal moneylenders was exploitative and therefore a stable, reliable and reasonable credit delivery system is a necessity to prevent the exploitation of rural households by the informal moneylenders.

### ***3.3.4 Determinants for Households' Decision to Borrow***

The determinants for access to credit, enlisted in Table 3.7, reveal that the number of members in a family affects the probability of access to credit in a positive way,

**Table 3.6** Interest rate and share of moneylender in non-institutional credit

| State             | Interest rate (% per annum) |      | Share in non-institutional credit (%) |      |
|-------------------|-----------------------------|------|---------------------------------------|------|
|                   | 2003                        | 2013 | 2003                                  | 2013 |
| Andhra Pradesh    | 31.9                        | 26.1 | 81.4                                  | 93.1 |
| Arunachal Pradesh | 7.7                         | 5.1  | 31.9                                  | 8.2  |
| Assam             | 29.8                        | 42.8 | 55.9                                  | 34.8 |
| Bihar             | 51.8                        | 60.1 | 62.3                                  | 66.8 |
| Chhattisgarh      | 41.1                        | 27.9 | 58.7                                  | 55.6 |
| Gujarat           | 29.9                        | 37.2 | 24.8                                  | 33.2 |
| Haryana           | 28.8                        | 26.9 | 77.6                                  | 78.7 |
| Himachal Pradesh  | 17.1                        | 12.5 | 11.2                                  | 7.5  |
| Jammu & Kashmir   | 1.2                         | 19.4 | 4.8                                   | 0.9  |
| Jharkhand         | 21.9                        | 59.6 | 25.6                                  | 38.9 |
| Karnataka         | 40.1                        | 33.4 | 72.0                                  | 65.7 |
| Kerala            | 42.8                        | 39.6 | 47.0                                  | 53.0 |
| Madhya Pradesh    | 32.3                        | 32.9 | 71.5                                  | 85.9 |
| Maharashtra       | 50.6                        | 37.5 | 40.1                                  | 42.3 |
| Manipur           | 62.7                        | 45.7 | 70.9                                  | 82.9 |
| Meghalaya         | 17.3                        | 33.0 | 27.5                                  | 13.3 |
| Mizoram           | 3.9                         | 6.1  | 18.2                                  | 20.4 |
| Nagaland          | 39.5                        | 45.8 | 19.8                                  | 16.1 |
| Odisha            | 55.6                        | 42.9 | 84.5                                  | 61.6 |
| Punjab            | 31.4                        | 26.3 | 63.5                                  | 60.1 |
| Rajasthan         | 25.7                        | 25.8 | 71.4                                  | 91.4 |
| Sikkim            | 30.8                        | 23.9 | 41.8                                  | 46.0 |
| Tamil Nadu        | 41.4                        | 35.3 | 86.5                                  | 87.1 |
| Tripura           | 23.1                        | 23.7 | 20.1                                  | 15.5 |
| Uttar Pradesh     | 47.8                        | 52.0 | 59.1                                  | 43.8 |
| Uttarakhand       | 57.3                        | 31.7 | 28.8                                  | 34.4 |
| West Bengal       | 53.0                        | 45.0 | 38.2                                  | 47.5 |
| India             | 39.1                        | 37.1 | 67.3                                  | 69.0 |

*Data source* Unit-level data on debt and investment surveys: 59th (2003) and 70th (2013) rounds. National Sample Survey Organization, New Delhi

that is, bigger the family, higher are the chances to borrow. Also, with increase in the age of family head, the chances of family getting access to credit decrease. The male-headed households have been noted to have less access to credit than the female-headed households. The landholding pattern also affects the access to credit. With increase in landholding size, the access to credit also increases. The access to credit with respect to social groups shows that access to credit of scheduled caste households is more and of scheduled tribe households is less as compared to the



**Table 3.7** Determinants for access to credit in rural India

| Dependent variable: credit (yes = 1, no = 0)   |             |                |
|------------------------------------------------|-------------|----------------|
| Parameter                                      | Coefficient | Standard error |
| Family size (no.)                              | 0.0809***   | (0.00202)      |
| Age of household head (years)                  | -0.00135*** | (0.000319)     |
| Gender of household head (male-1, otherwise-0) | -0.233***   | (0.0128)       |
| Operated land (ha)                             | 0.0859***   | (0.00511)      |
| <i>Social group</i>                            |             |                |
| ST-1, otherwise-0                              | -0.215***   | (0.0155)       |
| SC-1, otherwise-0                              | 0.0953***   | (0.0133)       |
| OBC-1, otherwise-0                             | 0.0376***   | (0.0110)       |
| <i>Education level</i>                         |             |                |
| Below primary-1, otherwise-0                   | -0.0333**   | (0.0155)       |
| Primary-1, otherwise-0                         | 0.0164      | (0.0180)       |
| Secondary-1, otherwise-0                       | 0.0214      | (0.0151)       |
| Higher secondary-1, otherwise-0                | -0.00719    | (0.0186)       |
| <i>Household type</i>                          |             |                |
| Agricultural labour-1, otherwise-0             | -0.0263     | (0.0170)       |
| Other labour-1, otherwise-0                    | 0.00830     | (0.0174)       |
| Self-employed in agri.-1, otherwise-0          | 0.147***    | (0.0117)       |
| Self-employed in non-agri.-1, otherwise-0      | 0.157***    | (0.0181)       |
| Constant                                       | 0.174***    | (0.0366)       |
| State-fixed effect                             | Yes         |                |
| No. of observations                            | 110,800     |                |
| LR $\chi^2$ (50)                               | 7798.92     |                |
| Pseudo $R^2$                                   | 0.0586      |                |
| log likelihood                                 | -62664.29   |                |

Note \*\*\*, \*\* and \* indicate level of significance at 1, 5 and 10%, respectively

general category households. The access to credit of backward class households is also higher as compared to the general category households.

The access to credit has been found to be influenced by the level of education. The household heads, not having even primary-level education, have less access to credit. However, no difference has been observed in having access to credit when a household head was primary or secondary educated. Lastly, the type of household did not have a significant difference in access to credit. The households self-employed in agriculture or non-agriculture have higher probability of borrowing. The socio-demographic and household characteristics have depicted a mixed effect on rural households' access to credit.

### 3.3.5 Determinants for Access to Institutional Credit

Table 3.8 presents a clear picture of the parameters that affect the access to institutional credit in rural India. The observation on family size reveals that with increase in family size, the access to institutional credit decreases. The age of family head affects the access to institutional sources of credit positively because age denotes experience and better decision-making capacity. The male-headed households are seen to have less access to credit than the female-headed households. The increase in the landholding of a household also increases the access to institutional credit.

**Table 3.8** Determinants of access to institutional credit

| Dependent variable: institutional credit (yes 1, otherwise 0) |             |                |
|---------------------------------------------------------------|-------------|----------------|
| Parameter                                                     | Coefficient | Standard error |
| Family size (no.)                                             | −0.0467***  | (0.00371)      |
| Age of head (years)                                           | 0.0109***   | (0.000239)     |
| Gender (male-1, otherwise-0)                                  | −0.191***   | −0.0154        |
| Operated land (ha)                                            | 0.0301***   | (0.00326)      |
| <i>Social group</i>                                           |             |                |
| ST-1, otherwise-0                                             | 0.114***    | (0.0161)       |
| SC-1, otherwise-0                                             | −0.239***   | (0.00985)      |
| OBC-1, otherwise-0                                            | −0.140***   | (0.00750)      |
| <i>Education level</i>                                        |             |                |
| Below primary-1, otherwise-0                                  | −0.836***   | (0.0115)       |
| Primary-1, otherwise-0                                        | −0.759***   | (0.0127)       |
| Secondary-1, otherwise-0                                      | −0.582***   | (0.0112)       |
| Higher secondary-1, otherwise-0                               | −0.292***   | (0.0138)       |
| <i>Household type</i>                                         |             |                |
| Agricultural labour-1, otherwise-0                            | −0.243***   | (0.0116)       |
| Other labour-1, otherwise-0                                   | −0.257***   | (0.0116)       |
| Self-employed in agri.-1, otherwise-0                         | −0.0995***  | (0.0112)       |
| Self-employed in non-agri.-1, otherwise-0                     | −0.166***   | (0.0135)       |
| IMR                                                           | −1.877***   | (0.105)        |
| Constant                                                      | 1.742***    | (0.0964)       |
| State-fixed effects                                           | Yes         | Yes            |
| No. of observations                                           | 225111      |                |
| LR $\chi^2$ (51)                                              | 21913.93    |                |
| Pseudo $R^2$                                                  | 0.0702      |                |
| log likelihood                                                | −145047.17  |                |

Note \*\*\*, \*\* and \* is indicate level of significant at 1, 5 and 10% level

The study on the relation between different social groups and the access to institutional credit has revealed that scheduled castes and other backward classes have lower access to institutional credit compared to the general category. On the other hand, scheduled tribes have higher access to institutional credit compared to the general category. The education level of an individual also affects the access to institutional credit. Table 3.8 reveals that when education level increases from primary to higher secondary, the access to institutional credit also increases, but is less than that of a graduate degree holder. The relationship between the type of households and access to institutional credit reveals that all types of households have less access to institutional credit than the households earning regular salaries. Further, the value of Mills ratio suggests that there are unobserved characteristics that influence both the decision to borrow (first regression) and access to institutional sources of credit (second regression).

### 3.3.6 *Impact of Institutional Credit on Farm Income and Household Consumption Expenditure*

Does access to institutional credit improve farm income and household consumption expenditure? Table 3.9 compares average net returns per unit of cropped area for formal and informal borrowers by farm size. In calculating the net returns from farming, gross returns from different crops are estimated. Net returns are estimated by deducting expenses from gross returns. Net returns are divided by cropped area. Some important observations stand out from the summary comparison of farm incomes across formal and informal borrowers. First, access to institutional credit is associated with higher farm income. The net farm income of formal borrowers (Rs. 43,740/ha) is significantly higher than that of informal-sector borrowers

**Table 3.9** Institutional credit, net farm income and household consumption expenditure

| Farm category | Net farm income (Rs./ha) |                   | Difference in means ( <i>t</i> statistic) | Consumption expenditure (Rs./month/person) |                   | Difference in means ( <i>t</i> statistic) |
|---------------|--------------------------|-------------------|-------------------------------------------|--------------------------------------------|-------------------|-------------------------------------------|
|               | Formal borrower          | Informal borrower |                                           | Formal borrower                            | Informal borrower |                                           |
| Marginal      | 49,118                   | 41,862            | -0.7306 <sup>ns</sup>                     | 1695                                       | 1279              | 6.5833***                                 |
| Small         | 45,044                   | 32,389            | 5.0369***                                 | 1629                                       | 1424              | 4.6708***                                 |
| Medium        | 44,848                   | 29,802            | 6.1876***                                 | 1750                                       | 1789              | -0.1350 <sup>ns</sup>                     |
| Large         | 40,840                   | 23,847            | 4.9189***                                 | 2158                                       | 1931              | 1.6224 <sup>ns</sup>                      |
| All           | 43,740                   | 33,734            | -0.9450 <sup>ns</sup>                     | 1744                                       | 1483              | 3.2587***                                 |

Authors analysis based on unit-level data on situation assessment survey of agricultural households, 70th round. National Sample Survey Organization, New Delhi

(Rs. 33,734/ha). Second, the relationship between farm size and net returns per hectare is negative. The inverse relationship between farm size and productivity in India has been observed in some recent studies too (e.g., Chand et al. 2011; Birthal et al. 2013). And finally, the difference in farm incomes of formal and informal buyers increases with farm size. Moreover, the difference is statistically significant at 1%.

### 3.4 Conclusions

The study has revealed that the structure of credit market in rural India has changed overtime and the share of institutional credit in borrowing by rural households has increased. The initiatives taken by the government seem to have paid off, and the flow of institutional credit in rural areas has increased significantly in real terms. The indicators of financial inclusion have shown a sign of improvement though the disparity in disbursement of rural credit continues to persist across different states of the country and social groups. The presence of informal agencies in the disbursement of rural credit is still intact though they charge higher interest rates. The access of rural households to institutional credit is influenced by a number of socio-economic, institutional and policy factors. In our analysis, the education, caste affiliation, gender and assets ownership have been found to influence the access of rural households to institutional credit significantly.

The study has some important policy implications. The formal financial institutions should develop more flexible products and services to meet the income and expenditure pattern of different strata of rural households. These institutions should be more proactive in spreading financial literacy to overcome the hurdles posed by the level of education of the prospective borrowers. Further simplification of the procedures of lending is required. Land still remains the predominant form of collateral which constrains the poor rural household's access to credit from formal financial institutions. The recently launched *Jan Dhan Yojana* is expected to improve financial inclusion in the rural areas, and such efforts need to be consolidated.

### Annexures

See Tables 3.10, 3.11, 3.12 and 3.13

**Table. 3.10** State-wise amount of institutional and non-institutional borrowings: 1992, 2003 and 2013 (‘₹’/ha at 1993–94 price)

| States            | Institutional sources |        |        | Non-institutional sources |       |        | All sources |        |        |
|-------------------|-----------------------|--------|--------|---------------------------|-------|--------|-------------|--------|--------|
|                   | 1992                  | 2003   | 2013   | 1992                      | 2003  | 2013   | 1992        | 2003   | 2013   |
| Andhra Pradesh    | 504                   | 2418   | 2827   | 1467                      | 4030  | 3973   | 1970        | 6448   | 6801   |
| Arunachal Pradesh | 81                    | 71     | 443    | 62                        | 19    | 111    | 143         | 90     | 554    |
| Assam             | 148                   | 336    | 716    | 181                       | 387   | 285    | 330         | 723    | 1001   |
| Bihar             | 275                   | 387    | 1362   | 261                       | 1259  | 3348   | 536         | 1646   | 4710   |
| Chhattisgarh      | 222                   | 495    | 774    | 76                        | 369   | 424    | 299         | 864    | 1199   |
| Gujarat           | 582                   | 1976   | 1551   | 197                       | 633   | 829    | 780         | 2608   | 2380   |
| Haryana           | 578                   | 4308   | 2552   | 519                       | 2666  | 1629   | 1097        | 6974   | 4181   |
| Himachal Pradesh  | 1121                  | 2624   | 9167   | 738                       | 1967  | 1598   | 1859        | 4591   | 10,765 |
| Jammu & Kashmir   | 296                   | 1097   | 3008   | 396                       | 229   | 1139   | 692         | 1326   | 4147   |
| Jharkhand         | 203                   | 1609   | 692    | 12                        | 160   | 850    | 215         | 1769   | 1542   |
| Karnataka         | 465                   | 1817   | 2884   | 276                       | 1090  | 2493   | 740         | 2907   | 5378   |
| Kerala            | 4819                  | 29,270 | 60,500 | 1073                      | 6587  | 15,921 | 5893        | 35,857 | 76,421 |
| Madhya Pradesh    | 326                   | 1035   | 1160   | 238                       | 627   | 712    | 564         | 1662   | 1872   |
| Maharashtra       | 721                   | 1833   | 2066   | 215                       | 513   | 823    | 936         | 2347   | 2890   |
| Manipur           | 119                   | 111    | 278    | 105                       | 1316  | 549    | 224         | 1426   | 827    |
| Meghalaya         | 45                    | 70     | 316    | 4                         | 114   | 81     | 49          | 185    | 397    |
| Mizoram           | 98                    | 282    | 676    | 46                        | 52    | 59     | 144         | 334    | 734    |
| Nagaland          | 164                   | 911    | 360    | 61                        | 367   | 191    | 225         | 1278   | 551    |
| Odisha            | 209                   | 1236   | 1600   | 89                        | 548   | 941    | 298         | 1784   | 2542   |
| Punjab            | 1398                  | 5478   | 5414   | 961                       | 4701  | 3304   | 2359        | 10,179 | 8718   |
| Rajasthan         | 166                   | 483    | 1445   | 383                       | 765   | 1692   | 550         | 1247   | 3137   |
| Sikkim            | 390                   | 1605   | 6064   | 6                         | 512   | 245    | 395         | 2117   | 6309   |
| Tamil Nadu        | 2388                  | 6988   | 10,350 | 1469                      | 7998  | 6289   | 3857        | 14,987 | 16,638 |
| Tripura           | 895                   | 2449   | 1410   | 170                       | 859   | 880    | 1066        | 3308   | 2290   |
| Uttar Pradesh     | 395                   | 1164   | 2313   | 325                       | 1007  | 1501   | 721         | 2171   | 3814   |
| Uttarakhand       | 557                   | 709    | 7105   | 1367                      | 606   | 1776   | 1924        | 1315   | 8881   |
| West Bengal       | 641                   | 1494   | 3285   | 514                       | 1578  | 3088   | 1155        | 3072   | 6373   |
| India             | 545                   | 1916   | 2926   | 435                       | 1440  | 1924   | 980         | 3356   | 4850   |
| CV (%)            | 145.1                 | 206.2  | 236.1  | 108.2                     | 131.1 | 152    | 118.1       | 168.2  | 208.4  |

*Data source* Unit-level data on debt and investment surveys, 48th (1992), 59th (2003) and 70th (2013) rounds. National Sample Survey Organization, New Delhi

**Table. 3.11** State-wise amount of institutional and non-institutional borrowings: 1992, 2003 and 2013 (‘₹’/capita at 1993–94 price)

| State             | Institutional sources |       |       | Non-institutional sources |       |       | All sources |       |      |
|-------------------|-----------------------|-------|-------|---------------------------|-------|-------|-------------|-------|------|
|                   | 1992                  | 2003  | 2013  | 1992                      | 2003  | 2013  | 1992        | 2003  | 2013 |
| Andhra Pradesh    | 87                    | 290   | 497   | 253                       | 483   | 698   | 340         | 774   | 1195 |
| Arunachal Pradesh | 14                    | 17    | 90    | 10                        | 5     | 23    | 24          | 21    | 113  |
| Assam             | 16                    | 33    | 72    | 20                        | 38    | 29    | 36          | 72    | 101  |
| Bihar             | 25                    | 26    | 62    | 24                        | 83    | 153   | 49          | 109   | 216  |
| Chhattisgarh      | 64                    | 102   | 126   | 22                        | 76    | 69    | 86          | 178   | 195  |
| Gujarat           | 145                   | 384   | 315   | 49                        | 123   | 168   | 194         | 507   | 483  |
| Haryana           | 183                   | 645   | 455   | 164                       | 399   | 291   | 347         | 1044  | 746  |
| Himachal Pradesh  | 124                   | 258   | 730   | 82                        | 193   | 127   | 206         | 451   | 857  |
| Jammu & Kashmir   | 44                    | 130   | 229   | 58                        | 27    | 87    | 102         | 157   | 315  |
| Jharkhand         | 30                    | 147   | 51    | 2                         | 15    | 63    | 32          | 162   | 114  |
| Karnataka         | 112                   | 341   | 510   | 66                        | 205   | 441   | 178         | 545   | 952  |
| Kerala            | 278                   | 1201  | 2413  | 62                        | 270   | 635   | 339         | 1471  | 3048 |
| Madhya Pradesh    | 104                   | 236   | 252   | 76                        | 143   | 155   | 179         | 379   | 406  |
| Maharashtra       | 192                   | 387   | 435   | 57                        | 108   | 173   | 249         | 496   | 608  |
| Manipur           | 13                    | 11    | 30    | 12                        | 126   | 59    | 25          | 137   | 88   |
| Meghalaya         | 6                     | 10    | 35    | 1                         | 17    | 9     | 7           | 27    | 44   |
| Mizoram           | 16                    | 51    | 110   | 7                         | 9     | 10    | 23          | 60    | 120  |
| Nagaland          | 25                    | 84    | 47    | 9                         | 34    | 25    | 35          | 119   | 72   |
| Odisha            | 30                    | 137   | 148   | 13                        | 61    | 87    | 43          | 198   | 235  |
| Punjab            | 248                   | 796   | 838   | 170                       | 683   | 512   | 419         | 1478  | 1350 |
| Rajasthan         | 69                    | 142   | 372   | 159                       | 225   | 436   | 228         | 367   | 808  |
| Sikkim            | 76                    | 156   | 590   | 1                         | 50    | 24    | 78          | 206   | 614  |
| Tamil Nadu        | 226                   | 526   | 776   | 139                       | 602   | 472   | 365         | 1127  | 1248 |
| Tripura           | 39                    | 91    | 64    | 7                         | 32    | 40    | 46          | 123   | 104  |
| Uttar Pradesh     | 56                    | 121   | 191   | 46                        | 104   | 124   | 103         | 225   | 315  |
| Uttarakhand       | 49                    | 57    | 441   | 121                       | 48    | 110   | 171         | 105   | 551  |
| West Bengal       | 54                    | 83    | 139   | 43                        | 88    | 131   | 96          | 171   | 269  |
| India             | 98                    | 254   | 363   | 79                        | 191   | 239   | 177         | 445   | 602  |
| CV (%)            | 88.4                  | 113.5 | 125.8 | 102.7                     | 112.9 | 103.1 | 82.6        | 104.4 | 110  |

*Data source* Unit-level data on debt and investment surveys, 48th (1992), 59th (2003) and 70th (2013) rounds. National Sample Survey Organization, New Delhi

**Table. 3.12** Indicators for participation of weaker sections in institutional rural credit

| State             | Ratio of SC and ST's share in institutional credit and population |      | Ratio of OBC's share in institutional credit and population |      |
|-------------------|-------------------------------------------------------------------|------|-------------------------------------------------------------|------|
|                   | 2003                                                              | 2013 | 2003                                                        | 2013 |
| Andhra Pradesh    | 0.54                                                              | 0.54 | 0.88                                                        | 0.96 |
| Arunachal Pradesh | 1.15                                                              | 1.06 | 0.00                                                        | 0.00 |
| Assam             | 1.09                                                              | 1.06 | 0.74                                                        | 1.10 |
| Bihar             | 0.47                                                              | 0.27 | 0.74                                                        | 0.92 |
| Chhattisgarh      | 0.70                                                              | 0.45 | 1.28                                                        | 0.96 |
| Gujarat           | 0.45                                                              | 0.53 | 0.79                                                        | 0.76 |
| Haryana           | 0.37                                                              | 0.29 | 0.94                                                        | 0.47 |
| Himachal Pradesh  | 0.72                                                              | 0.65 | 1.11                                                        | 0.55 |
| Jammu & Kashmir   | 0.78                                                              | 0.67 | 0.08                                                        | 0.41 |
| Jharkhand         | 0.43                                                              | 0.43 | 1.44                                                        | 1.46 |
| Karnataka         | 0.32                                                              | 0.64 | 0.65                                                        | 1.06 |
| Kerala            | 0.32                                                              | 1.15 | 0.92                                                        | 0.91 |
| Madhya Pradesh    | 0.46                                                              | 0.33 | 1.12                                                        | 1.42 |
| Maharashtra       | 0.44                                                              | 0.57 | 0.91                                                        | 1.05 |
| Manipur           | 0.75                                                              | 0.72 | 1.25                                                        | 1.28 |
| Meghalaya         | 1.01                                                              | 0.89 | 3.00                                                        | 8.50 |
| Mizoram           | 1.01                                                              | 1.02 | 0.00                                                        | 0.00 |
| Nagaland          | 1.05                                                              | 1.01 | 0.00                                                        | 0.00 |
| Odisha            | 0.50                                                              | 0.56 | 1.01                                                        | 0.95 |
| Punjab            | 0.19                                                              | 0.16 | 0.37                                                        | 1.26 |
| Rajasthan         | 0.75                                                              | 0.72 | 1.25                                                        | 1.16 |
| Sikkim            | 1.25                                                              | 1.51 | 0.88                                                        | 0.43 |
| Tamil Nadu        | 0.34                                                              | 0.45 | 1.22                                                        | 1.24 |
| Tripura           | 0.98                                                              | 0.84 | 1.28                                                        | 1.57 |
| Uttar Pradesh     | 0.65                                                              | 0.44 | 0.85                                                        | 1.05 |
| Uttarakhand       | 1.06                                                              | 0.27 | 2.30                                                        | 0.98 |
| West Bengal       | 0.77                                                              | 0.70 | 1.13                                                        | 1.20 |
| India             | 0.44                                                              | 0.49 | 0.98                                                        | 1.13 |

**Table. 3.13** Socio-economic status of the rural households

| Parameter                                                  | Mean  | Standard deviation |
|------------------------------------------------------------|-------|--------------------|
| Family size (No.)                                          | 4.82  | 2.33               |
| Age of household head (years)                              | 47.55 | 13.56              |
| Gender of household head (male-1, female-0)                | 0.88  | 0.32               |
| Operated land (ha)                                         | 0.68  | 1.36               |
| Caste (ST-1, otherwise-0)                                  | 0.19  | 0.39               |
| Caste (SC-1, otherwise-0)                                  | 0.18  | 0.39               |
| Caste (OBC-1, otherwise-0)                                 | 0.39  | 0.49               |
| Caste (others-1, otherwise-0)                              | 0.24  | 0.43               |
| Education (below primary-1, otherwise-0)                   | 0.52  | 0.50               |
| Education (primary-1, otherwise-0)                         | 0.13  | 0.33               |
| Education (secondary-1, otherwise-0)                       | 0.26  | 0.44               |
| Education (higher secondary-1, otherwise-0)                | 0.05  | 0.23               |
| Education (graduate and above-1, otherwise-0)              | 0.04  | 0.19               |
| Household type (agricultural labour-1, otherwise-0)        | 0.13  | 0.33               |
| Household type (other labour-1, otherwise-0)               | 0.12  | 0.33               |
| Household type (self employee in agri.-1, otherwise-0)     | 0.48  | 0.50               |
| Household type (self employee in non-agri.-1, otherwise-0) | 0.11  | 0.31               |
| Household type (other-1, otherwise-0)                      | 0.16  | 0.37               |

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# Chapter 4

## Investment Behaviour of Farmers Across Indian States: Determinants and Impact on Agriculture Income

Seema Bathla and Yashi Kumari

### 4.1 Introduction

Agriculture is a household economic activity, primarily undertaken by small and medium farmers across varied geographical locations in India. Farmers invest on machinery, on-farm and off-farm inputs, irrigation and other assets and off-farm activities to maintain the production and productivity of their land and increase income. Private investments in agriculture, principally undertaken by farmers, are met through personal savings and in some cases from borrowings. Quite often, private capital in agriculture is deterred by risks involved, less developed and inefficient factor and output markets, which necessitate public intervention through adequate credit flow and investments in irrigation, markets and infrastructure. Though the share of public capital formation in total capital formation in agriculture is hardly 20%, it holds considerable importance due to its positive effect on private investment, land productivity and rural poverty alleviation (Fan 2008). Availability of land, labour, institutional credit and favourable price structure are added factors that significantly influence agricultural growth through their impact on private capital formation.

The positive inter-linkages between public and private capital formation and agricultural growth have been demonstrated at the national level in several studies (Rath 1989; Chand 2000; Gulati and Bathla 2002; Chand and Kumar 2004) and at the state level in Bathla (2014a, b). Literature is, however, scant on an analysis of investment behaviour of farmers in terms of their preference to invest, changes in the composition of investment within agriculture and sources of finance over the

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period. Dhawan and Yadav (1995) undertook a detailed cross-sectional analysis on this based on NSS 1981–82 and found that irrigation development and canal irrigation capacity were key factors in influencing investment in implements and machinery. Bisaliah et al. (2013) attempted to study private farm investment in various assets and its determinants in three states using cost of cultivation data from 1981 to 2007. The size and composition of investment in farm and non-farm business may have undergone sizeable change in each state as well as across the size of landholdings in recent years, which have not been explored in detail. The present study aims to fill this gap by analysing unit-level household data collected by the NSSO in its decennial report All India debt and investment survey (AIDIS) (Schedule 18.2) 1981–82 (37th round) 1991–92 (4th round), 2002–03 (59th round), and 2012–13 (70th round) across 17 major states.

The specific objectives are to analyse the (i) temporal and spatial patterns in fixed capital expenditure (synonymous with capital formation and investment) in various activities by rural households, (ii) changes in the composition and growth of investment in farm business, also termed as private investment and its sources of finance, (iii) determinants of private investment and its impact on agricultural income (gross state domestic product). These objectives will be useful to gauge investment behaviour of farmers and understand the factors behind a sharp deceleration in the rate of growth in investment during the 1980s and the 1990s and revival thereafter for further policy suggestions. The chapter is organized into five sections. Following Introduction, Sect. 4.2 provides the structure and composition of fixed capital expenditure of rural households across the major Indian states. It also delves into the magnitude of each investment activity to reflect the changing preference of farmers over a period of 30 years. Section 4.3 analyses changes in the extent and composition of investment in agriculture as per size of landholdings. It also examines the sources of finance for purchase of farm assets by households. Section 4.4 empirically investigates the factors that influence investment behaviour of farmers and its impact on agricultural income using a simultaneous equation model. The last section draws conclusions.

## **4.2 Structure and Composition of Fixed Capital Expenditure of Rural Households**

The NSS survey classifies rural household investment into gross capital expenditure (GCE) and fixed capital expenditure (FCE) each having three sub-categories, viz. residential land and buildings, farm business and non-farm business. GCE is a broader concept which is equal to FCE, purchase of land and normal repairs and maintenance. FCE in farm business, referred to private capital formation or investment, encompasses eight components, major being land improvement, live-stock, irrigation, transport, and machinery and implements. The non-farm business covers expenditure on manufacturing and other activities, land improvement,

purchase of equipment and other accessories. The survey considers expenditure on land improvement, land rights as components of fixed capital formation and exclude value of land in estimation of capital. The sources of investment and its destination in farm or non-farm business are important aspects to consider. It reflects how investment possibilities are constrained by cash flow and factors that influence it across farm and non-farm businesses in a developing country like India because of complex nature of relationship, imperfections and interventions in the market. Traditionally, investment decisions were isolated from any kind of uncertainty and risk involved to the return of the project. But in reality, investments are undertaken based on measured risk and uncertainties of return/profit as it is wait-and-watch kind of situation due to rational nature of farmer/entrepreneur towards utility maximization (Gallerani et al. 2008).

Table 4.1 provides composition of FCE in terms of its percentage share into residential land and buildings (RLB), farm business (FB) and non-farm business (NFB). It shows investment in RLB has always been higher compared to FB and NFB. The share of RLB in total FCE has consistently increased from 54.3 to 67.9% between 1981 and 2012. There is hardly any change in the share of NFB in total FCE, whereas the share of FB has gone down from 35.3 in 1981 to 21.8% in 2002 and slightly up by two percentage points in 2012. Only in a few states viz. Punjab and undivided UP, Gujarat, HP and MP the share of FB has increased from 37.05 to 47.16% and in UP from 30.6 to 37.3% during 2002 to 2012. The analysis indicates that investment in RLB is at the expense of FB, especially during the past decade. A relative decline in private investment in agriculture is relatively more in the developed states such as, Maharashtra, Tamil Nadu, and Haryana. It indicates preference of farmers towards investment in RLB perhaps due to rising nuclear family system and hence faster division of land. It could also be due to growing urbanization, industrialization and acquisition of land for making roads and highways, which may have pushed price of land in the developed states, and hence prospects of higher returns from its sale. The interstate disparities in RLB and NFB are found to have gone up by two percentage points over the period compared to that in FB which has fallen from 85.9 to 63.76% between 1981–82 and 2012–13. Investment in non-farm business has gone up in Assam, Andhra Pradesh, Karnataka, Kerala and Rajasthan.

In terms of growth, the 1990s witnessed a low rate of growth in investment in RLB at 2.64% per annum and a negative growth in farm business in almost all the states. The farmers invested more in non-farm business, which is clear from higher annual rate of growth at 7.58%. Only exceptions were Assam, Karnataka, Kerala and Uttar Pradesh, which observed a negative growth. A perceptible shift in investment from NFB to RLB and FB is noticeable in 2000. Compared to RLB, investment in NFB has not increased much except in Bihar, Karnataka, Kerala, Rajasthan, Odisha and Uttar Pradesh. The annual rate of growth in RLB and FB is much higher at 9% compared to 3.5% in NFB though large interstate variations are visible (Table 4.2). Among all the states, Assam, Andhra Pradesh, Bihar, Karnataka, Kerala, Uttar Pradesh, MP and Rajasthan have experienced higher rates of growth in all the three activities.

**Table 4.1** Composition of FCE by rural HH (percentage share of each in total FCE)

| States            | 1981-82 |       |       | 1991-92 |       |        | 2002-03 |       |        | 2012-13 |       |        |
|-------------------|---------|-------|-------|---------|-------|--------|---------|-------|--------|---------|-------|--------|
|                   | RLB     | FB    | NFB   | RLB     | FB    | NFB    | RLB     | FB    | NFB    | RLB     | FB    | NFB    |
| Andhra Pradesh    | 47.59   | 40.61 | 11.58 | 58.65   | 37.14 | 4.21   | 52.26   | 19.02 | 28.72  | 64.22   | 20.22 | 15.5   |
| Assam             | 61.33   | 25.23 | 13.26 | 77.29   | 11.67 | 10.73  | 75.68   | 17.74 | 6.76   | 68.66   | 22.20 | 9.14   |
| Bihar             | 70.19   | 21.22 | 8.07  | 57.50   | 33.00 | 9.50   | 62.86   | 15.78 | 21.36  | 88.97   | 9.02  | 2.05   |
| Gujarat           | 34.80   | 56.90 | 8.15  | 54.47   | 31.45 | 14.07  | 50.80   | 37.30 | 11.90  | 42.61   | 50.93 | 6.46   |
| Haryana           | 38.99   | 53.45 | 7.54  | 83.40   | 15.54 | 1.05   | 36.70   | 27.40 | 35.90  | 85.58   | 11.94 | 2.47   |
| Himachal Pradesh  | 74.74   | 23.25 | 1.79  | 68.86   | 15.63 | 15.50  | 81.50   | 8.30  | 10.30  | 74.81   | 21.39 | 3.80   |
| Jammu and Kashmir | 65.41   | 13.85 | 20.59 | 62.52   | 21.56 | 15.92  | 78.00   | 12.20 | 9.70   | 84.28   | 12.50 | 3.21   |
| Karnataka         | 52.64   | 39.04 | 8.33  | 39.35   | 54.14 | 6.51   | 69.70   | 23.00 | 7.30   | 68.85   | 22.90 | 8.25   |
| Kerala            | 79.62   | 11.94 | 8.34  | 71.16   | 9.18  | 19.66  | 81.60   | 6.60  | 11.80  | 79.38   | 9.32  | 11.30  |
| Madhya Pradesh    | 40.49   | 49.39 | 10.12 | 38.64   | 58.12 | 3.23   | 44.90   | 34.90 | 20.20  | 44.01   | 51.88 | 4.11   |
| Maharashtra       | 35.76   | 48.84 | 15.06 | 48.36   | 45.22 | 6.49   | 58.70   | 29.70 | 11.60  | 59.80   | 32.45 | 7.74   |
| Odisha            | 67.05   | 19.22 | 13.29 | 76.94   | 15.54 | 7.27   | 53.50   | 13.50 | 33.00  | 76.38   | 16.11 | 7.51   |
| Punjab            | 31.91   | 52.00 | 16.04 | 51.46   | 46.22 | 2.31   | 51.70   | 37.10 | 11.20  | 42.48   | 47.16 | 10.36  |
| Rajasthan         | 58.26   | 34.80 | 6.84  | 50.32   | 45.85 | 3.83   | 52.10   | 40.50 | 7.50   | 61.40   | 27.02 | 11.58  |
| Tamil Nadu        | 59.05   | 32.47 | 8.36  | 67.74   | 26.31 | 5.88   | 76.80   | 14.30 | 9.00   | 85.15   | 5.72  | 9.14   |
| West Bengal       | 74.80   | 17.08 | 8.00  | 66.40   | 18.33 | 15.07  | 80.30   | 5.20  | 14.50  | 88.72   | 5.17  | 6.12   |
| AP-Telangana      |         |       |       |         |       |        |         |       |        | 60.30   | 24.91 | 14.79  |
| Bihar-Jharkhand   |         |       |       |         |       |        | 72.66   | 12.68 | 14.57  | 75.39   | 13.77 | 10.8   |
| MP-Chhattisgarh   |         |       |       |         |       |        | 60.27   | 25.59 | 14.10  | 54.01   | 41.15 | 4.8    |
| UP-Uttarakhand    | 54.15   | 34.49 | 11.22 | 64.43   | 27.35 | 8.14   | 63.65   | 30.91 | 5.38   | 59.84   | 30.36 | 9.84   |
| India             | 54.34   | 35.30 | 10.46 | 59.46   | 32.81 | 7.81   | 64.10   | 21.80 | 14.10  | 67.94   | 23.32 | 8.74   |
| CV                | 68.52   | 85.9  | 88.29 | 92.12   | 68.63 | 124.82 | 91.76   | 78.67 | 112.65 | 70.87   | 63.76 | 110.29 |

Source AIDIS

Note: *RLB* Residential land and buildings; *FB* farm business (agriculture); *NFB* non-farm business; *CV* is coefficient of variation. New states merged with their respective parent state in 2002 and 2012. Data for Telangana available only in 2012

**Table 4.2** Annual rate of growth in key activities (per rural HH at 2004-05 Prices): 1981-91, 1991-2002 and 2002-2012

| States           | RLB   | FB     | NFB    | All   | RLB   | FB     | NFB   | All   | RLB   | FB    | NFB    | All   |
|------------------|-------|--------|--------|-------|-------|--------|-------|-------|-------|-------|--------|-------|
| Andhra Pradesh   | 0.43  | -2.52  | -11.10 | -1.64 | 4.26  | -0.86  | 25.46 | 5.36  | 11.88 | 10.27 | 3.08   | 9.59  |
| Assam            | -1.33 | -10.74 | -5.61  | -3.59 | -0.39 | 3.67   | -4.31 | -0.20 | 6.35  | 9.83  | 10.69  | 7.39  |
| Gujarat          | 4.63  | -5.71  | 5.67   | 0.05  | 1.88  | 4.15   | 0.97  | 2.53  | 4.78  | 9.99  | 0.33   | 6.63  |
| Haryana          | 15.60 | -5.32  | -12.00 | 7.13  | -6.79 | 5.76   | 38.42 | 0.44  | 18.03 | -0.20 | -17.02 | 8.44  |
| Himachal Pradesh | 8.02  | 4.67   | 35.18  | 8.91  | 12.06 | 4.18   | 6.29  | 10.36 | -0.11 | 10.76 | -8.78  | 0.75  |
| J&K              | -5.09 | -0.35  | -7.08  | -4.66 | 10.54 | 2.89   | 3.59  | 8.33  | 8.16  | 7.56  | -3.92  | 7.33  |
| Karnataka        | -0.19 | 6.17   | 0.24   | 2.75  | 2.32  | -10.15 | -1.79 | -2.86 | 15.17 | 15.29 | 16.67  | 15.32 |
| Kerala           | 1.10  | -0.42  | 11.39  | 2.24  | 4.96  | 0.61   | -1.04 | 3.66  | 7.94  | 12.02 | 7.77   | 8.24  |
| Maharashtra      | 5.86  | 1.93   | -5.57  | 2.72  | 2.92  | -2.67  | 6.60  | 1.12  | 9.40  | 10.17 | 4.88   | 9.20  |
| Odisha           | 0.48  | -2.98  | -6.70  | -0.90 | 6.32  | 8.48   | 26.08 | 9.89  | 2.47  | 0.66  | -14.71 | -1.11 |
| Punjab           | 0.82  | -5.01  | -20.82 | -3.89 | 2.77  | 0.68   | 18.61 | 2.72  | 3.84  | 8.48  | 5.03   | 5.90  |
| Rajasthan        | -0.31 | 3.99   | -4.54  | 1.16  | 1.04  | -0.40  | 7.03  | 0.73  | 14.25 | 7.93  | 17.43  | 12.38 |
| Tamil Nadu       | 5.85  | 2.24   | 0.80   | 4.41  | 4.56  | -2.20  | 7.42  | 3.38  | 10.84 | 0.10  | 9.92   | 9.70  |
| West Bengal      | -3.63 | -1.78  | 3.90   | -2.48 | 9.08  | -4.38  | 6.82  | 7.21  | 9.46  | 8.29  | -0.57  | 8.37  |
| Bihar-Jharkhand  | -8.68 | -2.64  | -5.31  | -6.84 | 5.21  | -5.58  | 7.08  | 3.00  | 14.23 | 14.77 | 10.50  | 13.81 |
| MP-Chhattisgarh  | 6.86  | 9.12   | -4.22  | 7.36  | -4.46 | -14.84 | 4.90  | -8.24 | 13.21 | 20.03 | 2.85   | 14.46 |
| UP-Uttaranchal   | 3.21  | -0.90  | -1.78  | 1.43  | 3.44  | 4.74   | -0.26 | 3.56  | 1.76  | 2.18  | 8.71   | 2.39  |
| India            | 2.45  | 0.80   | -1.38  | 1.54  | 2.64  | -1.77  | 7.58  | 1.94  | 9.22  | 9.31  | 3.50   | 8.58  |

Source NSS AIDIS

It is apparent that the annual rate of growth in investment FB had been modest for a long period and significantly increased at a rate of 9.3% per annum during the 2000s. With a few exceptions, the rate of growth is found to be negative during the 1980s and the 1990s in most of the states, thereby confirming deceleration in its growth reported at the national level and revival thereafter. The highest growth between 8 and 15% was experienced by almost all the states with a few exceptions, viz. Haryana, Odisha, Tamil Nadu and Uttar Pradesh. Massive public investments in irrigation, provision of input subsidies, favourable terms of trade and increased flow of credit seem to have pushed private investment in agriculture and its growth, especially in the less developed states (Chand and Parappurathu 2012; Bathla 2016).

#### ***4.2.1 Composition of Investment in Agriculture***

A detailed probing into real investment in agriculture per rural household<sup>1</sup> in Table 4.3 reveals that it increased from Rs. 753 in 1981 to Rs. 815 in 1991, fell to Rs. 669 in 2002 and then shot up to Rs. 1631 in 2012. Despite an impressive increase in investment in FB, its share in gross capital expenditure (GCE) has gone down from nearly 20 to 15% in 2002 and slightly up by three percentage points in 2012. Three states, viz. Haryana, Bihar and Tamil Nadu have experienced significant decline in the share of private capital formation in agriculture in gross capital formation. It further confirms that an increasing expenditure on residential land by the rural households is undertaken at the expense of investment in agriculture. Notably, interstate disparities in investment in FB, which were estimated to be higher during the 1980s and 1990s, have slightly come down.

The analysis reveals that bulk of investment of rural HH during 1981–82 went into purchase of machinery and transport (46.1%), followed by expenditure on irrigation structures (25.4%) and land improvement (14.8%). Expenditure on irrigation became more important during 1991–92 as its share in total FCEFB went up to 31.8% and that in orchards declined. Similar trends were observed during 2002–03 and 2012–13, whereby the largest expenditure share (more than 60%) was on implements and transport and irrigation structures. Table 4.4 shows an unchanged preference of farmers towards asset creation over the period. Another important point to note is that a substantial share of expenditure was devoted to livestock (13.83%) in 2002–03 which increased to 23.01% in 2012. Among all assets, transport, machinery and implements, livestock and irrigation together attract 80% of rural household investments. Availability of credit at subsidised rate of interest seems to have provided strong incentives to purchase these assets. Large interstate variations in each investment item exist barring irrigation and livestock. During

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<sup>1</sup>The analysis is done for rural households due to high share of cultivator households and change in the definition of farm household in NSS 70th round survey different from that considered in the preceding rounds. Estimates on farm households could not be made comparable due to non-availability of unit-level data for 1981–82.

**Table 4.3** State-wise FCE in FB (agriculture) by rural HH (Rs.) at 2004–05 price

| State            | 1981–82 |           | 1991–92 |           | 2002–03 |           | 2012–13 |           |
|------------------|---------|-----------|---------|-----------|---------|-----------|---------|-----------|
|                  | FCEFB   | FCEFB/GCE | FCEFB   | FCEFB/GCE | FCEFB   | FCEFB/GCE | FCEFB   | FCEFB/GCE |
| Andhra Pradesh   | 687     | 20.30     | 533     | 21.55     | 484     | 16.12     | 1287    | 17.25     |
| Assam            | 248     | 13.84     | 80      | 6.37      | 119     | 10.65     | 303     | 14.86     |
| Bihar            | 186     | 9.82      | 142     | 15.68     | 73      | 6.53      | 172     | 6.00      |
| Gujarat          | 1405    | 39.08     | 781     | 23.37     | 1220    | 29.56     | 3163    | 38.93     |
| Haryana          | 2029    | 27.73     | 1429    | 10.93     | 2646    | 18.75     | 2593    | 10.75     |
| Himachal Pradesh | 496     | 12.29     | 783     | 11.72     | 1228    | 6.63      | 3412    | 19.01     |
| Jammu & Kashmir  | 538     | 7.62      | 520     | 14.17     | 711     | 9.13      | 1475    | 9.69      |
| Karnataka        | 1045    | 19.19     | 1902    | 38.67     | 586     | 17.43     | 2430    | 19.09     |
| Kerala           | 686     | 8.00      | 658     | 7.73      | 703     | 5.09      | 2188    | 7.16      |
| Madhya Pradesh   | 664     | 22.02     | 1589    | 40.10     | 353     | 18.73     | 3019    | 40.63     |
| Maharashtra      | 1129    | 28.95     | 1367    | 31.51     | 1015    | 22.46     | 2674    | 26.00     |
| Odisha           | 181     | 8.42      | 134     | 7.42      | 327     | 10.81     | 350     | 11.16     |
| Punjab           | 3245    | 36.19     | 1940    | 29.14     | 2091    | 23.21     | 4720    | 37.49     |
| Rajasthan        | 1134    | 23.42     | 1677    | 33.83     | 1605    | 23.25     | 3442    | 23.59     |
| Tamil Nadu       | 634     | 20.63     | 791     | 20.51     | 620     | 11.89     | 626     | 5.21      |
| Uttar Pradesh    | 769     | 18.86     | 703     | 17.05     | 831     | 19.63     | 2253    | 29.82     |
| West Bengal      | 232     | 10.31     | 194     | 9.73      | 119     | 3.87      | 263     | 4.15      |
| AP-Telangana     |         |           |         |           |         |           | 1150    | 14.66     |
| Bihar-Jharkhand  |         |           |         |           | 76      | 6.53      | 300     | 8.59      |
| MP-Chhattisgarh  |         |           |         |           | 272     | 12.49     | 1685    | 26.68     |
| UP-Uttarakhand   |         |           |         |           | 1170    | 21.76     | 1451    | 23.19     |
| All-India        | 753     | 20.17     | 815     | 22.24     | 669     | 15.56     | 1631    | 18.78     |
| CV               | 85.9    |           | 70.7    |           | 85.4    |           | 69.4    |           |

Source AIDIS

Note Deflated using GDCF given in NAS, CSO; The newly created states are merged with their parent states to make the estimates comparable. Telangana (AP); Chhattisgarh (MP); Uttarakhand (UP) and Jharkhand (Bihar)

**Table 4.4** Share of investment in key assets in total FCE in agriculture in 2012–13

| Investment item      | Low share in FCEFB                                                | High share in FCEFB                                               | Rate of growth (2002–12) | CV 2002–03 | CV 2012–13 |
|----------------------|-------------------------------------------------------------------|-------------------------------------------------------------------|--------------------------|------------|------------|
| Land improvement     | WB, Bihar, Punjab, Haryana, Assam (1–3.5%)                        | Karnataka, MP, Odisha, Maharashtra, Himachal Pradesh (10–20%)     | Positive                 | 95.36      | 107.57     |
| Orchards             | Haryana, Punjab, Karnataka, MP, AP (0–0.05%)                      | Kerala, J&K, Bihar, Maharashtra, Himachal Pradesh (3–16%)         | Negative                 | 160.57     | 171.91     |
| Irrigation           | J&K, UP, Assam, West Bengal, Bihar (1–10%)                        | Himachal Pradesh, AP, Maharashtra, Karnataka, Tamil Nadu (30–48%) | Positive                 | 139.71     | 103.01     |
| Implements-Transport | Himachal Pradesh, J&K, Karnataka, Tamil Nadu, Maharashtra (6–22%) | West Bengal, Haryana, UP, Kerala, Punjab (40–65%)                 | Negative                 | 104.05     | 138.98     |
| Farm buildings       | Haryana, UP, Karnataka, MP, Punjab (0.74–1.2%)                    | Odisha, West Bengal, Tamil Nadu, Assam, Himachal Pradesh (10–25%) | Positive                 | 128.27     | 193.99     |
| Livestock            | Tamil Nadu, Kerala, MP, Himachal Pradesh, Maharashtra (10–20%)    | Rajasthan, AP, West Bengal, Bihar, J&K (30–65%)                   | Negative                 | 94.77      | 90.82      |
| Others               | AP, Himachal Pradesh, Haryana, J&K, Karnataka (0.06–1%)           | Odisha, Assam, MP, UP, Kerala (1–6%)                              | Negative                 | 195.97     | 159.77     |

Source NSS AIDIS; New states merged with their respective parent states



**Table 4.5** Percentage share of FCE in agriculture as per land size during 2012–13

|                  | Marginal<br>(≤1 ha) | Small<br>(1–2 ha) | Semi-medium<br>(2–4 ha) | Medium<br>(4–10 ha) | Large<br>(>10 ha) |      |
|------------------|---------------------|-------------------|-------------------------|---------------------|-------------------|------|
| Andhra Pradesh   | 2.83                | 3.05              | 24.56                   | 61.79               | 7.75              | 100  |
| Assam            | 6.29                | 8.60              | 12.05                   | 73.06               | 0.00              | 100  |
| Bihar            | 0.48                | 2.39              | 1.10                    | 5.74                | 90.29             | 100  |
| Gujarat          | 3.93                | 11.96             | 20.44                   | 48.06               | 15.61             | 100  |
| Haryana          | 1.00                | 10.67             | 19.41                   | 6.80                | 62.11             | 100  |
| Himachal Pradesh | 3.90                | 8.48              | 15.50                   | 4.11                | 68.02             | 100  |
| Jammu & Kashmir  | 17.14               | 11.22             | 10.85                   | 60.79               | 0.00              | 100  |
| Karnataka        | 2.50                | 9.08              | 25.34                   | 12.58               | 50.50             | 100  |
| Kerala           | 18.64               | 60.37             | 20.99                   | 0.00                | 0.00              | 100  |
| Madhya Pradesh   | 1.27                | 4.46              | 7.10                    | 26.13               | 61.05             | 100  |
| Maharashtra      | 1.42                | 8.98              | 10.80                   | 18.38               | 60.43             | 100  |
| Odisha           | 1.22                | 4.60              | 34.75                   | 15.53               | 43.89             | 100  |
| Punjab           | 1.18                | 8.68              | 28.00                   | 30.15               | 32.00             | 100  |
| Rajasthan        | 5.80                | 18.01             | 25.96                   | 23.95               | 26.28             | 100  |
| Tamil Nadu       | 1.25                | 6.68              | 80.30                   | 11.78               | 0.00              | 100  |
| Uttar Pradesh    | 3.84                | 8.64              | 17.76                   | 22.51               | 47.24             | 100  |
| West Bengal      | 5.53                | 33.50             | 60.97                   | 0.00                | 0.00              | 100  |
| AP-Telangana     | 4.17                | 9.05              | 21.46                   | 51.71               | 13.61             | 100  |
| Bihar-Jharkhand  | 1.64                | 4.48              | 1.95                    | 7.57                | 84.35             | 100  |
| MP-Chhattisgarh  | 1.35                | 4.68              | 8.23                    | 29.51               | 56.23             | 100  |
| UP-Uttarakhand   | 4.07                | 15.35             | 23.02                   | 19.59               | 37.96             | 100  |
| All India        | 1.97                | 7.49              | 17.42                   | 25.80               | 47.31             | 100  |
| CV               | 233.61              | 167.24            | 99.57                   | 236.23              | 171.56            | 91.5 |

**Table 4.6** Percentage of farm investment from borrowings and share of institutional credit in total: 2012–13

| States           | % of FCEFB from borrowing | % borrowing from institutional agencies |
|------------------|---------------------------|-----------------------------------------|
| Andhra Pradesh   | 98.9                      | 44.6                                    |
| Assam            | 49.9                      | 61.4                                    |
| Bihar            | 70.2                      | 53.2                                    |
| Gujarat          | 84.4                      | 78.8                                    |
| Haryana          | 65.7                      | 61.1                                    |
| Himachal Pradesh | 42.6                      | 64.2                                    |
| Jammu & Kashmir  | 36.9                      | 43.8                                    |

(continued)

**Table 4.6** (continued)

|                 |      |      |
|-----------------|------|------|
| Karnataka       | 89.2 | 58.4 |
| Kerala          | 95.5 | 82.7 |
| Madhya Pradesh  | 90.5 | 79.8 |
| Maharashtra     | 91.7 | 71.3 |
| Odisha          | 66.1 | 70.9 |
| Punjab          | 95.4 | 77.7 |
| Rajasthan       | 86.6 | 55.9 |
| Tamil Nadu      | 95.5 | 46.6 |
| Uttar Pradesh   | 83.5 | 47.2 |
| West Bengal     | 79.2 | 69.4 |
| AP-Telangana    | 98.8 | 41.8 |
| Bihar-Jharkhand | 65.3 | 47.1 |
| MP-Chhattisgarh | 76.9 | 58.3 |
| UP-Uttarakhand  | 85.5 | 64.3 |
| All India       | 85.9 | 63.4 |

**Table 4.7** Correlation matrix of FCE agriculture with other variables

| HH expenditure on:     | 1981–82 | 1991–92 | 2002–03 | 2012–13 |
|------------------------|---------|---------|---------|---------|
| GCE                    | 0.70*   | 0.74*   | 0.85*   | 0.65**  |
| FCE: non-farm business | 0.72*   | 0.23    | 0.53*   | 0.48**  |
| FCE: RLB               | 0.49*** | 0.60*   | 0.68*   | 0.67*   |
| Institutional credit   | 0.33*   | 0.79*   | 0.89*   | 0.62**  |
| FCE: Irrigation        | −0.02   | 0.84*   | —       | 0.78*   |

Note \*, \*\* and \*\*\* level of significance at 1, 5 and 10%—denotes not available

**Table 4.8** Determinants of private investment in agriculture and farm income: empirical results 1981–2013; observations 527

|     |                                                                                                                                                                                                                                                                                          |
|-----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| (1) | Agriculture income = 0.19**(GCA) + 0.17*(employment) + 0.083**(private investment agriculture) + 0.49*(public investment irrigation) + 0.10*(public investment agriculture R&D) + 0.04(road density) + 0.11*(electricity consumption agriculture) + 0.08*(rainfall) + 1.17; $R^2$ : 0.91 |
| (2) | Private investment agriculture = 0.48*(public investment irrigation) − 1.2*(investment preference) + 0.83*(TOT) + 0.31*(institutional credit) + 0.26*(road density) − 0.13*(electricity consumption agriculture) − 0.03(rural literacy) − 0.65; $R^2$ : 0.90                             |
| (3) | Public investment irrigation = 0.27*(size of public spending) + 1.2*(per capita income) − 0.098**(input subsidy) − 0.03(growth deficit) − 0.02*(trend) + 38.2; $R^2$ : 0.81                                                                                                              |
| (4) | Terms of Trade = − 0.3*(agriculture income) + 0.2*(world price) + 0.19**(growth in non-agricultural income) + 0.08*(reform dummy) + 0.013*(trend) + 9.14*; $R^2$ : 0.61                                                                                                                  |

Note Variables are specified on per ha basis in double log form. Variables converted into 2004–05 prices using GDCF and SDP deflators. \* and \*\* denote level of significance at 1 and 5%

2012–13, farmers in hilly regions tend to spend less on irrigation structures and more on land improvement, livestock and farm buildings. In contrast, rural households in less developed states have higher share of expenditure on irrigation. Most of the states have shown positive rate of growth in each asset.

While overall investment in agriculture has significantly increased in the 2000s, small and marginal farmers continue to have a low share in it compared to medium and large land size holding farmers. Table 4.5 reveals that investment by marginal farmers holds only 1.9% share in total investment compared to medium and large farmers occupying 25.8 and 47.3%, respectively. The share of marginal and small farmers together in FCEA is less than 10% compared to semi-medium and medium category of farmers at 43.2%. Only in some of the states, viz. Gujarat, Haryana, Kerala, Rajasthan and West Bengal, small farmers have reasonably higher share in total investment. Recognizing that nearly 62% of farmers in India cultivate less than 2 ha of land, who spend a meagre amount on asset creation, is a matter of concern. Besides, disparities in FCE are found to be high among marginal and medium farmers as compared to small, semi-medium and large landholders. These findings suggest a need to increase credit flow to marginal and small farmers keeping in view their preference for capital, especially in livestock.

### 4.3 Sources of Financing Agriculture Investment

Credit acts as an enabling and critical input in the production process. It provides access to and usage of fertilizer, seeds and other inputs and is also highly correlated with capital formation. Many studies have found that the distribution of institutional credit is highly skewed in favour of southern regions as against central and north-eastern regions<sup>2</sup> (Sidhu and Gill 2006; Chavan 2013). Looking at this aspect from demand side, we find that 85.6% of farm investment in India is done through borrowed money—both institutional and non-institutional sources. Farmers' dependence on borrowed amount for FCE FB is more than 50% across all the states and is relatively higher in the developed states—more than 90% in AP, Kerala, TN, Punjab, Karnataka, Maharashtra and MP (Table 4.6). However, a pertinent question is out of total borrowings for investment, how much is done through institutional sources. While the national average is estimated to be 63.4%, the sub-national picture indicates agriculturally developed states to be reaping the benefits of financial institutions. The outreach of banks for farm loans needs to be increased in AP, Bihar, J&K, Rajasthan, TN and UP as the share of investment from institutional

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<sup>2</sup>The southern states with only 19% of the gross cropped area of the country accessed about 44% of the total disbursement in 2001–02. The central states accounted for 27% of the area and obtained only 14% share of the total disbursals. Further, the share of central region in total credit declined over time making distribution more skewed. The developed regions have greater access to institutional sources than the less developed regions.

sources is less in these, varying between 41 and 55%. Needless to say that marginal and small farmers depend more on informal sources in most of the states.

To sum up, the analysis reveals a phenomenal increase in per household real fixed capital expenditure. Investment in residential land and buildings constitutes a sizeable share at 68% followed by farm business at 23.3% and non-farm business at 8.7%. Capital expenditure on residential land and buildings has grown at a much higher rate 4.66% compared to farm and non-farm businesses at 2.52 and 3.31%, respectively, during this period. Low agriculture income,<sup>3</sup> demographic and market-driven factors may have prompted farmers to accelerate investment in residential buildings relative to farming. The analysis further reveals that more than 85.9% of investment in agriculture is undertaken through institutional and non-institutional borrowings. The figure goes as high as 98% in richer states indicating high dependence on borrowed amount for making investments. However, the share of institutional credit holds only 63.5% share in total farm investment which needs to be scaled up particularly in less developed states. Private investment in agriculture is highly correlated with GCE, RLB and institutional borrowings as shown in Table 4.7. Among FCE in agriculture, farmers spend a sizeable amount on construction of wells (irrigation) and hence show high correlation coefficient at 0.78. The relationship between expenditure on farm and non-farm business is statistically significant but weak compared to other variables, which indicates farmers growing preference towards investment in RLB.

#### **4.4 Determinants of Private Investment in Agriculture and Impact on Income**

What factors influence investment decisions of farm households? A large body of the literature has maintained that private investment in agriculture undertaken during the 1960s up to the 1980s was determined by favourable incentive structure (terms of trade), technology, public capital formation in irrigation, savings and penetration of institutional credit by cooperatives (Gandhi 1990; Misra and Hazell 1996; Binswanger and Shahidur 1992; Dhawan 1998; Gulati and Bathla 2002). The analysis in the subsequent decades reveals the importance of rate of return on private capital, credit by commercial banks, growth in food-processing industry and increase in the number of landholdings (Roy and Pal 2001; Chand and Kumar 2004; Bathla 2014a, b). Among these factors, vital role was stated to be of public investment and institutional credit. The impact of input subsidy has remained obscure over the period. It is cited to exert a positive influence on private

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<sup>3</sup>Chand et al. (2015) found that low and fluctuating farm incomes have adversely impinged upon the interests of farmers, especially youth to leave farming. A low growth in farm income and growing disparity between income of farmers and non-farmers are also associated with agrarian distress.

investment in Roy and Pal (2001) but concomitantly found to have an inverse relation with public investment (Gulati and Narayanan 2003; Bathla 2014a, b).

Studies carried out at the disaggregate level based on NSSO and other farm surveys endorse these findings. Development of canal irrigation capacity was the key factor that influenced farmers to invest in implements and machinery during 1981–82 (Dhawan and Yadav 1995, 1997). As per size of landholding, Bisaliah and Mahendra (2010) found that land, credit availability and literacy had positive impact on capital formation of marginal, small and large farmers during 1994–95 to 2007–08. In contrast, investments by semi-medium and medium farmers were influenced by land and credit. Investment by farmers in the Kangra district received financial assistance which helped to increase investment by 277% in machinery and implements, 26% in livestock and nearly 3% in farm buildings, overall average increment being 28% (Chandel and Swarup 2015).

A broad consensus that has emerged from extant literature is that private investment in agriculture is influenced by multiple factors, the most important being public investment and institutional credit. Investment, be it on public or private account, significantly contributes to enhance land productivity, agricultural growth and poverty alleviation. Since investment behaviour of farmers is undergoing rapid changes, it is likely to affect investments and agricultural growth in due course. We have attempted to empirically examine this aspect based on the following equations.

$$\begin{aligned} \text{Agriculture Income} = f(\text{GCA, Employment, Private Investment Agriculture,} \\ \text{Public Investment Irrigation, Public Investment Agriculture R\&D,} \\ \text{Road Density, Electricity Consumption Agriculture, Rainfall}) \end{aligned} \quad (4.1)$$

$$\begin{aligned} \text{Private Investment Agriculture} = f(\text{Public Investment Irrigation, Investment Preference,} \\ \text{TOT, Institutional Credit, Road Density,} \\ \text{Electricity Consumption Agriculture, Rural Literacy}) \end{aligned} \quad (4.2)$$

$$\begin{aligned} \text{Public Investment Irrigation} = (\text{Size of Public Spending, Per Capita Income,} \\ \text{Funds with Government, Input Subsidy,} \\ \text{Growth Deficit, Trend}) \end{aligned} \quad (4.3)$$

$$\begin{aligned} \text{Terms of Trade} = (\text{Agriculture Income, World Price,} \\ \text{Growth in Non-agricultural Income,} \\ \text{Reform dummy, Trend}) \end{aligned} \quad (4.4)$$

Equation (4.1) takes agriculture income (GSDPA/NSA) to be endogenous and positively influenced by exogenous factors, viz. GCA, rainfall, employment, agriculture R&D and infrastructure variables (rural road density and electricity consumption in agriculture) and two endogenous variables, viz. private investment in

agriculture and public investment in major medium irrigation system. Private investment in agriculture in turn is taken to be determined by farmers' preference to invest, captured through the share of FCERLB in FCE. It is expected to have a negative impact on farm investment. Other variables that may positively influence investment decision of farmers include public investment in irrigation, terms of trade, flow of institutional credit, literacy and infrastructure.

Equation (4.3) specifies public investment in irrigation to be endogenously governed by a few exogenous variables, viz. size of public spending, availability of funds, input subsidy, per capita income and growth deficit. The latter variable is represented by irrigation intensity to capture the growth deficit in agriculture from demand side. Low irrigation intensity would require more investment by the government in irrigation systems. Input subsidy is expected to bear a negative effect as more public resources into subsidy would be at the cost of investment. The final equation captures the factors that influence terms of trade that is changes in agricultural prices relative to non-agricultural prices. TOT, taken as an endogenous variable, would test the underlying hypothesis that it positively influences private investment in agriculture and may be negatively affected by higher supply of farm output. Another variable taken in the equation is growth in non-agriculture income, which is expected to have a positive impact on TOT as an increase in it would raise demand for agricultural goods and hence prices. Another variable, viz. world price index is included to gauge the impact of international trade on agricultural prices in the domestic markets. Time trend is included to capture the influence of other variables. A dummy variable 1 is taken from 1991 to see the impact of economic reforms.

Each equation includes state dummies to capture the state-level unobservable specific effects. The inter-linkages among farm income, investment and other variables are tested using a simultaneous equation model. This model has an advantage as it enables one to study the inter-linkages and addresses the problem of endogeneity. Since time series models usually suffer from the problem of multicollinearity, auto-correlated error term, omitted variable bias and non-stationarity of data and hence spurious regression, care has been taken to minimize such effects by appropriately specifying the variables and improving the estimation procedures. The model is solved using three-stage least squares method. The equations are estimated in double log functional form to get the elasticity estimates. A few variables such as road density are correlated with agriculture electricity consumption in Eq. (4.1), public funds with size of public spending in Eq. (4.3) and hence dropped. The endogeneity problem, which generally occurs in time series model, is controlled by taking variable in the lagged form or re-specifying it using the instrumental variable method (Baltagi 1996). Annexure 1 lists the variable name along with source of data and estimation procedure. State-level estimates on FCEFB and FCERLB are interpolated based on the past annual rate of growth. Except terms of trade and world price index, variables are specified on per hectare basis.

### 4.4.1 Results and Discussions

Table 4.8 provides empirical results obtained from estimation of equations using three-stage least squares method from 1981 to 2013. The coefficients of farm income equation reveal that it is significantly influenced by land, labour, rainfall and capital (both public and private). Public spending on irrigation matters the most as the coefficient is significant at 5% level with estimated elasticity to be 0.49. In contrast, the elasticity of private investment in agriculture is 0.083, which suggests that a 10% increase in FCE by farmers would raise land productivity by 0.8%. Among other variables, land, labour and electricity consumption hold importance with elasticity of 0.19, 0.17 and 0.11, respectively. Public spending on agriculture R&D (including soil conservation and crop-animal husbandry) is again important for raising productivity showing elasticity to be 0.10. These factors together explain nearly 91% of the variations in agriculture income as indicated by the  $R^2$ . The results validate the findings obtained in Fan et al. (1999) and Bathla et al. (2017) on the importance of raising productivity and income through an increase in private and public investments for faster reduction in rural poverty.

On what factors do private investment depends is the second question which we have captured through the model. Estimated results indicate it to be positively and significantly determined by public capital formation in irrigation, infrastructure and terms of trade. Among all the variables, elasticity is found to be relatively high for TOT at 0.83, and public investment at 0.48, suggesting a 10% increase in TOT and public investment would raise private investment by 8.3 and 4.8%, respectively. Results further show that farm investment is adversely affected by farmers' preference to invest in residential land and buildings. The elasticity estimate turns out to be high at 1.2 at 1% level of significance. A positive and significant relationship between public and private investments validates a complementary relationship between the two as maintained in the literature. Government has increased allocation of resources on irrigation from 2003 to 04, which is a positive step. But large interstate disparities in public spending on irrigation should be reversed by increasing budgetary outlays more to the poorer (less developed) agriculturally dependent states.

Equation (4.3) suggests public capital formation in irrigation depends on the availability of resources with the respective state governments. An increase in the size of public spending along with per capita income would result in greater allocation of resources towards irrigation, whereas more expenditure on input subsidy would cut down such investment. Since prices received by farmers for their produce relative to industrial products stand important for farmers to decide about making investments, Eq. (4.4) shows it to significantly depend on infrastructure, growth in non-farm income and world agriculture prices. The latter factor has assumed significance mainly during the post-economic reform period when India opened her markets to world markets. A comparative advantage that the country has in many agricultural commodities coupled with a relatively greater openness to international trade and favourable price regime improved price integration. While

world prices have positive impact on prices received in the domestic markets, an increase in land productivity reduces the chance to receive relatively high prices for their products. The estimated elasticity is 0.30, which suggests that a 1% increase in output would depress terms of trade by 0.3%. Finally, growth in non-farm income and reforms are estimated to have positively impacted TOT. The estimated value of  $R^2$  is 0.61.

## 4.5 Conclusions

This study has examined the investment behaviour of farm households using the decennial National Sample Survey Debt and Investment Surveys (Schedule 18.2) from 1981 to 2012. It begins with an analysis of spatial trends and variations in the composition of fixed capital expenditure followed by factors that determine investment in agriculture and its impact on farm income. The analysis reveals a phenomenal increase in real investment of rural households of which investment in residential land and buildings constitutes a sizeable share at 68% followed by farm business at 23.3% and non-farm business at 8.7%. It has also grown at a much higher rate 4.66% compared to investment farm and non-farm businesses at 2.52 and 3.31%, respectively, during this period. A higher growth is identified more in the developed states which may be explained by growing urbanization, expansion in industrial activities and demographic factors, that is a growing trend of nuclear family system and hence division of land. Land acquisition by the state governments for infrastructural development may have made such investments lucrative. Furthermore, farmers may prefer to invest more in land-buildings hoping to receive higher returns compared to that from crop cultivation, which has failed to yield reasonable income for quite some time. This has implications for agriculture in future as expenditure on non-farm activities is undertaken at the expense of investment in agriculture.

Empirical exercise based on three-stage least squares method lends support to these findings. Private investment in agriculture is found to be adversely affected by farmers' preference to invest for residential purposes. It is positively influenced by terms of trade, public investment in irrigation and infrastructure, and institutional credit. The analysis reveals that almost 85% of investment in agriculture is undertaken through borrowed amount of which the share of institutional borrowings stands at 63.4%. The outreach of banks needs to be scaled up especially in the less developed states and more to the small and marginal farmers who invest a relatively lesser amount. Further, public investment in irrigation has an inducement effect on private investment but it depends largely on the size of spending of respective state government, magnitude of input subsidy and demand-side factors.

Private investment and agricultural growth from the mid-1980s up to early 2000s were affected by sluggish growth in public investment and little reforms in the banking sector. The situation improved from 2003 to 04 when government pumped resources into irrigation and increased credit which to some extent encouraged



farmers. The analysis confirms that investment on both private and public accounts together with a favourable incentive structure and infrastructural development contributed to higher productivity and faster growth in agriculture. Keeping in view low income from farming, along with demographic and market-driven changes, it is important to uphold interest of all landholders in agriculture, which is possible through an increased flow of credit and spending on irrigation, and technology. It goes without saying that a proactive role of each state stands imperative.

## Annexure 1 Exogenous and Endogenous Variables Used and Source of Data

|                                   |                                                                                                                                                                                           |
|-----------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Rain                              | Annual rainfall index (fertilizer statistics of India)                                                                                                                                    |
| GDPGNA                            | Annual rate of growth in non-agriculture GSDP or non-agriculture income per capita (national accounts statistics—NAS)                                                                     |
| World price                       | World food price index, 2005 = 100, includes cereal, vegetable oils, meat, seafood, sugar, bananas and oranges price indices (international financial statistics)                         |
| TOT                               | Terms of trade based on 3 years moving average; estimated taking SDP agriculture current/constant price divided by SDP non-agr. current/constant price at 2004–05 (EPW data base and NAS) |
| Land productivity                 | Agricultural income/NSA (GSDPA/NSA) (NAS and agricultural statistics at a glance)                                                                                                         |
| Agri R&D                          | Public expenditure on agriculture R&D, soil conservation, crop and animal husbandry (finance accounts, GOI)                                                                               |
| Labour                            | Agriculture labour—all age group as per UPSS (NSS) per NSA                                                                                                                                |
| IRRI                              | Irrigation intensity: Percentage of cropped area irrigated by public and private sources (agricultural statistics at a glance)                                                            |
| ELECT                             | Electricity consumption in agriculture per hectare (annual reports of State electricity board and agricultural statistics at a glance)                                                    |
| FERT                              | Fertilizer consumption per hectare (fertilizer statistics of India)                                                                                                                       |
| ROAD                              | Road density measured in km per 1000 km <sup>2</sup> (statistical abstract of India and rural development statistics)                                                                     |
| Land                              | Gross cropped area (fertilizer statistics of India)                                                                                                                                       |
| Private investment in agriculture | Fixed capital expenditure in farm business (AIDIS 1981, 1991, 2002, 2013) The estimates are interpolated based on past growth rates                                                       |
| Share RBL/FCE                     | Private investment (FCE in land and building) as ratio of total FCE, AIDIS size of public spending – total public expenditure/GSDP                                                        |
| Input subsidy                     | Fertilizer + power + credit + irrigation estimated as follows                                                                                                                             |
| Fertilizer sub                    | Fertilizer subsidy estimated using unit rate based on all India estimates and then apportioned across states based on consumption (fertilizer statistics of India)                        |

(continued)

(continued)

|                                  |                                                                                                                                                                                                       |
|----------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Power sub                        | Power subsidy based on unit cost of supply minus agricultural tariff rate $\times$ consumption of power in agriculture (annual report of SEB)                                                         |
| Credit sub                       | Credit subsidy (only interest) based on loan outstanding of PACS, RRBs and CBs based on difference in lending rate of agri and non-agri sectors (NAFSCOB)                                             |
| Irrigation sub                   | Irrigation subsidy based on O&M Expenditure—receipts + interest income/receipts; 2nd estimate = irr subsidy + 1% of cumulative capital expenditure (exclude exp. on flood control (finance accounts)) |
| Public investment in agriculture | Public expenditure on minor, medium, major irrigation and command area development (finance accounts)                                                                                                 |

*Note* Public spending on each head comprises revenue and capital expenditure. The latter is measured as a stock variable based on accumulated expenditure at the end of 1981, that is the base year in the study. The annual depreciation is taken to be 10%

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# Chapter 5

## Supply Response Function in Indian Agriculture

Parmod Kumar

### 5.1 An Overview of the Supply Response Analysis

The advent of Green Revolution helped India to achieve self-sufficiency in foodgrains production. In order to attain self-sufficiency in foodgrains, there has been a considerable amount of public intervention in terms of agricultural input and price policies. The emphasis on the agricultural price policies, in the 1960s and 1970s, was to motivate the farmers to adopt improved methods of cultivation and increase productivity and thus, production. The policy framework was, however, modified in the 1980s, which now aimed at a fair sharing of the gains from the adoption of new technologies and public investment between both the farmers and the consumers. The major policy instruments to ensure gains to the farmers were ensuring minimum support price (MSP) for several commodities, maintaining buffer stocks of rice and wheat, procurement levy on rice mills and sugar factories, etc. An assurance of a reasonable support price motivated the farmers to adopt improved methods of cultivation and increase production. Such price support measures are likely to have an effect on the farmers' choice of production alternatives and on their accumulation of resources (Rao 1989). The agricultural price policy also recognized the fact that even after the application of modern technology and efficient production, the farmers may encounter losses in a free market economy and loose interest to undertake production. So, in order to benefit the farmers, input subsidies were also introduced along with the output price support programmes. While the central government provides subsidy on fertilizer, the state governments provide subsidies on irrigation and electricity by the means of lowering the user charges. However, in the post-liberalization period, there has been a declining trend in both acreage and yield in the case of major foodgrains such as wheat, rice and coarse cereals. Apart from the price incentives, various non-price factors such as

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increased availability of infrastructure, technological change, institutional and structural reforms can also affect the supply conditions in agriculture. How far price and non-price factors influence the farmers' supply response over a period is a pertinent question.

The supply side of agriculture mainly consists of production, which is an outcome of area and yield. The interaction of various price and non-price factors on farmers' decision on area and yield has been addressed by several studies in the past. In this chapter, we try to capture the supply response in terms of area and yield at the all-India level considering the period 1980–81 to 2013–14. The next two sections describe the model and variables specification followed by the section on results and discussion. The last section summarizes the findings. The data used in the study is secondary data base easily available from the sources of Ministry of Agriculture, Government of India.

The broad framework of supply response studies can be divided into two categories:

- 1 The Nerlovian model, which hypothesizes that farmers react in terms of price expectations and/or partial area adjustment
- 2 The supply function derived from the profit maximization framework

The seminal work of Nerlove (1958) on supply response assumes that the desired acreage is a function of expected price, whereas the actual acreage adjusts with the desired acreage with a time lag.

$$\begin{aligned} A_t^D &= a_0 + a_1 P_t^e + a_2 Z_t + u_t, \\ P_t^e &= P_{t-1}^e + \beta(P_t - P_{t-1}^e), \\ A_t &= A_{t-1} + \gamma(A_t^D - A_{t-1}), \end{aligned}$$

where

- $A_t$  Actual area under cultivation at period  $t$ ,
- $A_t^D$  Area desired to be under cultivation at time  $t$ ,
- $P_t$  actual price at time  $t$ ,
- $P_t^e$  expected price at time  $t$ ,
- $Z_t$  other exogenous factors affecting supply at time  $t$  and  $\beta, \gamma$  are the expectations and the adjustment coefficients, respectively.

The Nerlovian model allows one to estimate both the short-run and the long-run supply elasticities. The model also provides scope for incorporating non-price factors in farmers' supply decisions and has been modified and extended in such directions. Askari and Cummings (1977) have categorized such modifications in the 1960s and early 1970s. The modifications and extension of the Nerlovian model can be categorized under three broad aspects:

- (1) Modifications of the variables used by Nerlove
- (2) Modifications in the form of including new variables into the model
- (3) Extending the model to the quantitative situations not included in the Nerlovian model. Such attempts were made by extending the Nerlovian model in determining the supply response of perennial crops, slow-maturing crops and livestock.

The supply elasticity estimated from a supply response model should ideally reflect the extent of change in the planned output in response to the expected output price. Since both the planned output and expected prices are not observable, proxy variables have been used to represent both the expected price and output. In most of the time series studies of supply response, the acreage has been used as a proxy for the output as the acreage decision is more under the farmers' control rather than the output.<sup>1</sup> In the 1960s, many studies also used marketed surplus as the output variable and tried to assess the possible elasticity of marketed surplus with respect to the foodgrain price (Krishna 1962, 1965); Behrman (1966) and Paris (1970). The choice of price variables also differs across studies. The widely used price variables in the literature are the price of the concerned crop received by the farmers, the price of the output relative to the input prices, output prices deflated by the consumer price index and prices deflated by the prices of alternative crops. The price series used in the model has to be in accordance with the reasons that motivate the farmers to produce more output. For example, if the farmers are willing to produce more in order to increase their own consumption of the concerned crop, subject to rising input costs, the ratio of crop price to some index of input prices would be appropriate. But if the farmers wish to increase the acreage of the crop in order to purchase more of other goods or to keep the consumption of other goods same in the wake of rising prices, it is better to use either the crop price relative to the consumer price index or the crop price relative to the prices of alternative crops (Askari and Cummings 1977; Kohli 1996). It can also be pointed out that the use of appropriate deflators of the output prices not only reflects the motivation of the farmers to produce more output, but also the policy aspects. The supply elasticity in respect to input prices or output-to-input price ratio would indicate the effectiveness of the input price (fertilizer, tractor prices, interest rates and wage rates) policies on agricultural supply. In order to capture such effects, the output prices are often deflated by the fertilizer prices (Timmer and Falcon 1976; Peterson 1979; Ghosh and Neogi 1995; Mythili 2001, 2008). Depending on the importance of labour in agricultural production, the output prices can also be deflated by agricultural wage rate (Rahji and Adewumi 2008). The crop allocation decisions are also influenced by respective profitability for which data on the crop specific net returns is needed.

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<sup>1</sup>However, using absolute acreage as compared to the relative crop acreage (specific crop area as a share of the gross cropped area) has certain limitations as pointed out by Narain (1965). One of them is that use of absolute crop area fails to capture the substitution of crops when both crops show a rise in their absolute areas in response to an increase in the gross cropped area, but their relative areas may show opposite signs.

However, crop-specific data on net profitability is often unavailable and, hence, as a proxy gross returns per hectare (farm harvest price\* crop yield per hectare) is used (Gulati and Kelley 1999).

Studies on supply response in India indicate that in most of the cases the output response is less than proportionate for most of the crops. However, the supply response elasticities estimated in India differ across time and space considered for the studies, the levels of aggregation used (national and state), specification of the models and estimation methods. For example, for rice the estimates varied from 0.16 (Kumar and Rosergrant 1997; Jha and Srinivasan 1999) to 0.47 (Bapana et al. 1981). The long run all-India supply elasticities varied from 0.33 (Kumar and Rosergrant 1997, Kumar et. al. 1995) to as high as 0.85 (Krishna and Raychaudhuri 1980). Similarly, for wheat the supply elasticity at the all-India level was estimated to be as low as 0.09 (Jha and Srinivasan 1999) to as high as 0.92 (Krishna and Chhibber 1983).

Many empirical studies have also recognized the importance of price instability in supply response—Behrman (1968), Lin (1977), Hurt and Garcia (1982), Chavas and Holt (1990, 1996), Antonovitz and Green (1990), Pope and Just (1991), Holt (1993), etc. The supply elasticities with respect to price instability estimated in these studies were negative but varied widely across the commodities. For example, it was found that the supply elasticity of price instability for wheat and corn were  $-0.06$  and  $-0.033$ , respectively, as estimated by Lin (1977) and Chavas and Holt (1996), during the periods 1950–75 and 1954–78, respectively. But in the case of Hog, the supply elasticity of price instability was found to be as high as 0.5 for the period 1967–78. However, it is also important to note that the agricultural supply response to price instability depends upon the producer's risk aversion. If the risk aversion is moderate, an increase in price stability would lead to a reduction in supply, but under the situation of high-risk aversion it may lead to increase in supply as producers would try to work more in order to avoid adverse situations (Subervie 2005).

The basic Nerlovian Model, in terms of price variables, indicated the inclusion of various non-market variables in order to avoid the problems of identification while estimating the structural equations under the simultaneous equation framework. Among the non-price variables, rainfall, irrigation, fertilizer use, other infrastructure available like road density (Gulati and Kelley 1999) and the rural literacy rate (Mythili 2006) are the most important variables included in the supply response equations.

## 5.2 The Model Specification

The present study follows the comprehensive Nerlovian partial adjustment framework to estimate the area and yield response equations. Farmer's decision about the area cultivated for each crop is influenced by the price of the concerned crop, input prices and prices of alternative/competing crops. Among the non-price factors,

rainfall, irrigation, fertilizer use and the variables representing technology are important. The yield response is influenced by the price of the concerned crop,<sup>2</sup> input use (irrigation and fertilizer) and technology.

The area response equation used in the present study can be specified as follows:

$$A_{it} = \alpha + \beta P_t + \gamma Q_t + v_{it} \quad (4.1)$$

where

$A_{it}$  Area under  $i$ th crop at period  $t$

$P_t$  Vector of price variables influencing area decision of the farmers at period  $t$

$Q_t$  Vector of non-price variables influencing area decision of the farmers at period  $t$

The elements of  $P_t$  include

$rP_{it}$  the real price of the concerned crop at period  $t$

$rP_{jt}$  the real price of the  $j$ th crop (competing/alternative crop of the  $i$ th crop) at period  $t$

$rp_{ft}$  real price of fertilizer at period  $t$

In a few equations, we have used the relative prices, that is, the ratio of price of the  $j$ th crop (competing/alternative crop of the  $i$ th crop) and  $P_{it}$  (price of the concerned crop), and the ratio of  $P_{it}$  and  $P_{ft}$  (price of fertilizer) as the price variable influencing area response.

The elements of  $Q_t$  include

$I_t$  The percentage of irrigated area under the crop in the  $t$ th period

$R_t$  Rainfall Index during period  $t$

$U_{fert}$  Fertilizer use (kg/ha) at period  $t$

$T$  Time trend

$Y_{it}$  Yield of the  $i$ th crop at period  $t$

$Y_{jt}$  Yield of the  $j$ th crop which is an alternative/competing crop of the  $i$ th crop at period  $t$

$v_t$  Error term

In some of the equations, we have used the ratio of  $Y_{jt}$  to  $Y_{it}$  as the relative yield of the competing crops as compared to the concerned crop at period  $t$ .

The yield response equations are as follows:

$$Y_{it} = \alpha + \beta P_t + \gamma Q_t + v_{it},$$

where  $P_t$  denotes the vector of price variables which comprises of the following:

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<sup>2</sup>The own price is a determinant for area allocation for a particular crop by the farmers directly but it also influences yield rate indirectly possibly with a lag period. The farmers' profitability is determined by both price realized and the yield obtained. Therefore, the price obtained acts as an incentive for farmers for better input usage to realize higher productivity.



$rP_{it}$  is the real price of the concerned crop;  $rP_{ft}$  is the real price of the fertilizer. In a few equations, we have used the relative price, that is, of  $P_{it}$  (price of the concerned crop) and  $P_{ft}$  price of the fertilizer as the price variable influencing yield response.

The elements of  $Q_t$  include the following:

- $I_t$  The percentage of irrigated area under the crop during the  $t$ th period
- $R_t$  Rainfall Index at period  $t$
- $U_{\text{fert}}$  Fertilizer use (kg/ha) at period  $t$
- $T$  Time trend

### 5.3 Specification of Variables

The study used the time series of different price and non-price variables at the all-India level for the periods from 1980–81 to 2013–14. The specific crops for which the area and yield response equations are estimated are rice, wheat and kharif and rabi coarse cereals. The subgroups of coarse cereals consist of the crops specified by the Commission of Agricultural Costs and Prices (CACP). The following crops are included in each subgroup:

Kharif coarse cereals: Jowar, Bajra, Ragi and Maize

Rabi coarse cereals: Barley

The weighted averages or other forms of aggregation for the concerned explanatory variables have been considered to run the final regressions of each of these subgroups. However, the dependent variables are the overall area, yield, and production under kharif and rabi crops as given by Directorate of Economics and Statistics. The exact specifications of the explanatory variables used for the regressions are as follows:

- (a) The prices of crops: The study considers the farm harvest prices of the above-mentioned crops as the price variable. In the case of subgroups of commodities, weighted average of each subgroup is taken as the price of each subgroup of crops (kharif coarse cereals, rabi pulses, etc.), weights being the production share of each crop in the total production of the subgroup. It should be mentioned that the data for farm harvest prices of the concerned crops is collected from the *Farm Harvest Prices of India* (various issues) which is published on an annual basis and at the state level. In order to get the farm harvest prices of each crop at the all-India level, weighted average of state-level farm harvest prices have been considered for each crop. In the final model, index of the real farm harvest prices is used. The index is calculated as follows:

$$\text{FHPR} = (\text{farm harvest price at period } t / \text{farm harvest price at base period}) * 100$$

$$\text{IFHPR} = \text{FHPR} / \text{WPI},$$

where WPI is the wholesale price index, and IFHPR is the index of the real farm harvest price.

It is important to point out that for deflating FHPR, the average WPI from April to March (financial year) has been used in the case of rabi crops. However, for the kharif crops, keeping the relevant crop year in mind, the average WPI over the months of October–September has been used.

- (b) The price of competing or alternative crop: The price of competing crops is also an important factor in the farmers' area decisions. If prices of competing crops are higher, farmers will refrain from increasing the area under the concerned crops and go for the competing crop, which will fetch them higher returns. The prices of competing or the alternative crops in the present model have either been used separately or a composite farm harvest price of all the competing crops has been constructed. The weighted averages of the farm harvest prices of the competing crops are worked out, weights being the area share of each competing crop in the total area covered under the competing crops. The resultant composite farm harvest prices are then converted into real composite price indices for the competing crops following the procedure discussed earlier.
- (c) Fertilizer price: The state-wise data on the prices of  $N$ ,  $P$ , and  $K$  are first used to construct the series of aggregate fertilizer price by using their weighted average, weights being the respective share of each type of fertilizer in the total consumption in each state. The fertilizer prices at the all-India level are obtained by taking the weighted average of state-wise fertilizer prices, weights being the corresponding area shares of each state in the production of rice, wheat, and each crop under the subgroup. In order to obtain a fertilizer price for each subgroup of crops under consideration, we have used the weighted averages of these all-India fertilizer price figures where the weights were the all-India area share of each crop under the subgroup. The fertilizer price figures are converted into real prices by using WPI as the deflator. The fertilizer prices are used as a deflator for the crop prices in some of the cases. The real fertilizer prices are also used as an independent variable in the Yield Response Model. The real fertilizer price is expected to have a negative impact on the yield as it will discourage the farmers to use more fertilizers and, hence, yield will be hampered.
- (d) Fertilizer use: The state-wise data on the use of  $N$ ,  $P$ , and  $K$  fertilizers per hectare of cropped area has been weighted by the respective share of each type of fertilizer in their total consumption in each state and then their weighted averages are considered as the all-India figures of fertilizer use per hectare during the concerned period.
- (e) Irrigation: The percentage of gross-irrigated area under each crop to the gross cropped area under the respective crop.

- (f) Rainfall: The season-wise actual rainfall at the all-India level as a percentage of the normal rainfall for the respective seasons has been used in the study. Different rainfall indices have been used for different crops depending on the sowing season of each crop.
- (g) Lagged dependent variable: Finally, the lagged dependent variables are used to include the partial adjustment process in the model. We have also included time trend as a factor capturing the technological change. Suitable policy dummies have been used in the models in order to examine the effect of the respective policy changes on the area and yield response.

The following tables present the OLS estimates of area and yield response functions of various crops. All the variables except the dummy variables are included in logarithms.

## 5.4 Results and Discussions

Table 5.1 presents the area response functions for rice using various price specifications. On the whole, the estimated equations show a good fit ( $R^2 > 0.80$ ). The table exhibits that both price and non-price factors play an important role in determining farmers' decisions regarding area. The own price elasticity is low with a value around 0.10. The price elasticity becomes even lower when the price variable is considered relative to input (fertilizer) prices. The coefficients of the price of the competing crops are negative and statistically significant. The elasticity of rice area with respect to the price of the substitute crops is estimated to be slightly less than 0.10 for alternative specifications. The acreage elasticities vary across different studies in India, depending on the specific periods and the specification of the model. The short-run elasticity estimates for rice of the studies using data up to 1995 with OLS estimation exhibit elasticity estimates from 0.06 to 0.12 (Mythili 2006). However, Kumar (1998), following a joint estimation for inputs and output for the periods from 1970–1 to 1987–8 for cereal and coarse cereals, found a very low short-run price elasticity of rice acreage amounting to 0.01.

The regression results of the present study reveal that the importance of non-price factors such as irrigation is larger than that of the price factors. The acreage elasticity of rainfall is around 0.25, while the impact of irrigation in acreage decisions was also noteworthy (elasticity around 0.15). Our results corroborate the findings of the all-India level study for SAT regions by Gulati and Kelley (1999), where the non-price factors, especially irrigation, were found to be more prominent in farmers' acreage decision than the price factors. Kumar's (1998) study also strongly supports the importance of the non-price factors such as irrigation in the acreage decisions of farmers where the short-run elasticity of rice area with respect to irrigated area was estimated to be 0.32.

Table 5.2 shows the OLS estimates of the yield response function for rice. It can be observed from the estimated yield response equations of rice that the major

**Table 5.1** Area response for rice (for the periods from 1980–81 to 2013–14)

| Model | Constant         | Real domestic price | Real competing crop price | Rainfall       | Irrigation     | Price deflated by fertilizer/competing crop price | Yield ratio of competing crops | Lagged dependent | $R^2$ | DW   |
|-------|------------------|---------------------|---------------------------|----------------|----------------|---------------------------------------------------|--------------------------------|------------------|-------|------|
| 1     | -1.07<br>(-1.03) | 0.10<br>(1.15)      | -0.09<br>(-1.91)          | 0.26<br>(6.64) | 0.11<br>(2.36) |                                                   |                                | 0.74<br>(4.59)   | 0.80  | 2.59 |
| 2     | 1.21<br>(1.52)   |                     |                           | 0.26<br>(6.90) | 0.12<br>(2.93) | 0.09<br>(1.96)                                    |                                | 0.73<br>(5.03)   | 0.81  | 2.60 |
| 3     | 0.02<br>(0.04)   |                     |                           | 0.24<br>(6.35) | 0.17<br>(2.16) | -0.03<br>(-0.82)                                  |                                | 0.57<br>(4.39)   | 0.79  | 2.48 |
| 4     | -1.08<br>(-1.03) | 0.10<br>(1.15)      | -0.09<br>(-1.85)          | 0.27<br>(6.56) | 0.13<br>(2.50) |                                                   | 0.03<br>(0.89)                 | 0.69<br>(4.11)   | 0.80  | 2.59 |
| 5     | -0.01<br>(-0.02) |                     | -0.05<br>(-1.27)          | 0.24<br>(6.54) | 0.15<br>(1.84) | -0.004<br>(-0.12)                                 |                                | 0.62<br>(4.61)   | 0.79  | 2.58 |

**Table 5.2** Yield response for rice (for the periods from 1980–81 to 2013–14)

| Model | C               | Real domestic price | Rainfall       | Irrigation     | Fertilizer use | Lagged dependent | Trend           | R <sup>2</sup> | DW   |
|-------|-----------------|---------------------|----------------|----------------|----------------|------------------|-----------------|----------------|------|
| 1     | 4.32<br>(2.48)  | -0.03<br>(-0.27)    | 0.26<br>(3.69) | 0.30<br>(0.79) | 0.24<br>(3.12) |                  | 0.004<br>(0.93) | 0.95           | 1.69 |
| 2     | 2.82<br>(1.47)  | -0.02<br>(-0.15)    | 0.29<br>(3.60) | 0.88<br>(2.26) |                |                  | 0.01<br>(1.62)  | 0.94           | 1.21 |
| 3     | 2.02<br>(1.31)  | 0.01<br>(0.10)      | 0.27<br>(3.88) | 0.40<br>(1.36) | 0.21<br>(2.43) | 0.22<br>(1.69)   |                 | 0.95           | 2.29 |
| 4     | 4.12<br>(2.32)  | 0.01<br>(0.07)      |                | 0.36<br>(1.00) | 0.27<br>(2.65) | 0.09<br>(0.59)   |                 | 0.93           | 2.04 |
| 5     | -0.63<br>(-0.5) | 0.05<br>(0.36)      | 0.30<br>(4.09) | 0.95<br>(4.55) |                | 0.35<br>(2.71)   |                 | 0.94           | 2.13 |
| 6     | 4.12<br>(2.32)  | 0.01<br>(0.07)      |                | 0.36<br>(1.00) | 0.27<br>(2.65) | 0.09<br>(0.59)   |                 | 0.93           | 2.04 |

*Note* Figures in the parentheses indicate *t* values of the estimated coefficients

non-price factors behind yield response are rainfall, irrigation and fertilizer use where irrigation claims the highest importance. The elasticity of irrigation, rainfall and fertilizer ranged from 0.30 to 0.95, 0.26 to 0.30 and 0.21 to 0.27, respectively. The own price of rice did not show a strong impact on the yield response. However, the fertilizer use was found highly significant which indicates that the fertilizer price subsidies would help to encourage the farmers to attain higher yield in the case of rice.

The estimated area response equations of wheat are presented in Table 5.3. The estimated equations performed well in terms of explaining the total variation in wheat area. The acreage of wheat was found to be significantly influenced by the price of wheat as well as the price of competing crops. The results of the present study differ from the study by Gulati and Kelley (1999) conducted in the SAT region, using data for the period 1970–1994, where the price factors were insignificant in the area expansion of wheat and this was dominated by non-price factors like irrigation and rainfall. However, one should keep in mind that Gulati and Kelley's study concentrated on dry areas where price increases alone could not inspire the farmers to expand area under wheat without proper expansion of irrigation facilities. In our study, own price elasticity of wheat acreage was around 0.17. The coefficient of the competing crops has the expected negative sign. Irrigation and rainfall were also found to have a substantial impact on the area decision of the wheat farmers. The partial adjustment impact reflected by the coefficients of the lagged area variables is also stronger in the case of wheat.

The OLS estimations of the yield response functions of wheat are given in Table 5.4. The estimated equations are a good fit, showing high  $R^2$ . Among the non-price factors, irrigation and fertilizer use are found to have a significant positive contribution to the wheat yield. The elasticity of irrigation was quite high ranging from 1.24 to 1.70 across various specifications while the coefficient of fertilizer use was statistically significant with elasticities ranging from 0.01 to 0.13. The estimation also reveals that, unlike rice, the higher price of wheat has motivated the farmers to achieve better yield. This is reflected in the positive and statistically significant coefficient of the domestic price in the yield response equations. The area elasticities of own price ranged from 0.12 to 0.15. However, the effect of the price factor was less than that of non-price factors, namely irrigation and fertilizer use.

Rice and wheat are the two major cereals in Indian agriculture and considered to be the high growth crops which are blessed with the effect of green revolution. Coarse cereals which accounted for 16.3% of the total foodgrains production are considered to be slow-growing crops. The area under both kharif and rabi coarse cereals has been declining over time between the periods 1980–81 and 2013–14, with little increase in production, owing to the increase in yield.

The area and yield response estimations under kharif coarse cereals are presented in Tables 5.5 and 5.6. The area response equations reveal that the area under coarse cereals is highly responsive to domestic prices. Area elasticities in respect to own

**Table 5.3** Area response for wheat (periods from 1980–81 to 2013–14)

| Model | Constant         | Real competing crop price | Real domestic price | Price deflated by competing crop price | Irrigation     | Real fertilizer price (-1) | Rainfall       | Period dummy   | Lagged dependent | Dummy_NFSM      | R <sup>2</sup> | DW   |
|-------|------------------|---------------------------|---------------------|----------------------------------------|----------------|----------------------------|----------------|----------------|------------------|-----------------|----------------|------|
| 1     | -0.40<br>(-1.20) |                           |                     | 0.15<br>(3.97)                         | 0.36<br>(3.16) |                            | 0.14<br>(3.17) |                | 0.48<br>(3.96)   |                 | 0.92           | 2.07 |
| 2     | -1.05<br>(-2.34) | -0.12<br>(-2.42)          | 0.17<br>(3.43)      |                                        | 0.36<br>(3.12) |                            | 0.14<br>(3.21) |                | 0.47<br>(3.75)   |                 | 0.92           | 2.05 |
| 3     | -.37<br>(-1.04)  |                           |                     | 0.14<br>(3.31)                         | 0.37<br>(3.12) |                            | 0.13<br>(3.10) |                | 0.46<br>(3.47)   | 0.006<br>(0.34) | 0.92           | 2.07 |
| 4     | -2.57<br>(-2.30) |                           | 0.18<br>(3.08)      |                                        | 0.49<br>(2.29) | 0.06<br>(0.95)             | 0.14<br>(2.91) | 0.04<br>(1.84) | 0.52<br>(3.98)   |                 | 0.91           | 2.09 |

*Note* Figures in the parentheses indicate *t* values of the estimated coefficients

**Table 5.4** Yield response for wheat (periods from 1980–81 to 2013–14)

| Model | Constant         | Real domestic price | Rain-fall      | Price deflated by fertilizer price/comp crop price | Fertilizer use | Irrigation     | Real fertilizer Price | Lagged dependent | $R^2$ | DW   |
|-------|------------------|---------------------|----------------|----------------------------------------------------|----------------|----------------|-----------------------|------------------|-------|------|
| 1     | -1.86<br>(-1.57) | 0.14<br>(2.02)      | 0.14<br>(2.22) |                                                    | 0.01<br>(0.12) | 1.47<br>(3.23) |                       | 0.20<br>(1.18)   | 0.96  | 2.11 |
| 2     | 0.62<br>(0.60)   | 0.12<br>(1.51)      | 0.18<br>(2.55) |                                                    | 0.13<br>(1.90) |                |                       | 0.64<br>(5.20)   | 0.95  | 2.62 |
| 3     | -2.00<br>(-3.94) | 0.14<br>(2.33)      | 0.14<br>(2.29) |                                                    |                | 1.50<br>(3.97) |                       | 0.21<br>(1.21)   | 0.96  | 2.12 |
| 4     | -2.74<br>(-1.86) | 0.15<br>(2.361)     | 0.14<br>(2.29) |                                                    |                | 1.70<br>(3.21) | 0.04<br>(0.54)        | 0.16<br>(0.88)   | 0.96  | 2.11 |
| 5     | -1.30<br>(-2.60) |                     | 0.13<br>(2.06) | 0.17<br>(1.53)                                     |                | 1.54<br>(3.88) |                       | 0.21<br>(1.16)   | 0.96  | 2.11 |
| 6     | -0.58<br>(-0.77) |                     | 0.12<br>(2.00) | 0.07<br>(1.60)                                     |                | 1.24<br>(2.64) |                       | 0.26<br>(1.42)   | 0.96  | 2.15 |

*Note* Figures in the parentheses indicate  $t$  values of the estimated coefficients



**Table 5.5** Area response for kharif coarse cereals (for the periods from 1980–81 to 2013–14)

| Model | Constant         | Rainfall       | Real domestic<br>Price (-1) | Price deflated by<br>fertilizer/competing crop<br>price | Real<br>competing<br>crop price | Irrigation       | Real<br>fertilizer<br>price | Trend | Lagged<br>dependent | $R^2$ | DW   |
|-------|------------------|----------------|-----------------------------|---------------------------------------------------------|---------------------------------|------------------|-----------------------------|-------|---------------------|-------|------|
| 1     | -1.90<br>(-2.28) | 0.30<br>(4.26) | 0.36<br>(4.10)              | -0.32<br>(-3.36)                                        |                                 | -0.13<br>(-3.03) |                             |       | 0.75<br>(13.8)      | 0.95  | 2.06 |
| 2     | -1.69<br>(-2.00) | 0.28<br>(3.15) |                             | 0.26<br>(2.15)                                          |                                 | -0.16<br>(-3.31) |                             |       | 0.74<br>(10.1)      | 0.92  | 2.46 |
| 3     | 0.31<br>(0.40)   | 0.24<br>(2.68) |                             | -0.07<br>(-0.10)                                        |                                 | -0.09<br>(-1.53) |                             |       | 0.76<br>(8.57)      | 0.91  | 2.29 |
| 4     | -2.62<br>(-3.21) | 0.30<br>(4.26) | 0.36<br>(4.10)              |                                                         | -0.32<br>(-3.36)                | -0.13<br>(-3.03) |                             |       | 0.75<br>(13.8)      | 0.95  | 2.06 |
| 5     | -2.58<br>(-2.42) | 0.26<br>(3.14) | 0.28<br>(2.46)              |                                                         |                                 | -0.17<br>(-3.21) | -0.008<br>(-0.10)           |       | 0.81<br>(8.57)      | 0.92  | 2.10 |

Note Figures in the parentheses indicate  $t$  values of the estimated coefficients

**Table 5.6** Yield response for kharif coarse cereals (for the periods from 1980–81 to 2013–14)

| Model | C                | Rainfall       | Real domestic price<br>(-1) | Irrigation       | Time<br>trend  | Fertilizer<br>use | Real fertilizer<br>price | Lagged<br>dependent | $R^2$ | DW   |
|-------|------------------|----------------|-----------------------------|------------------|----------------|-------------------|--------------------------|---------------------|-------|------|
| 1     | -3.98<br>(-1.66) | 0.43<br>(2.38) | 0.63<br>(2.85)              | -0.21<br>(-1.68) |                | 0.45<br>(3.92)    |                          | 0.30<br>(1.72)      | 0.83  | 2.09 |
| 2     | -6.38<br>(-2.24) | 0.63<br>(2.91) | 0.52<br>(1.95)              | 0.03<br>(0.20)   |                |                   |                          | 0.84<br>(6.61)      | 0.75  | 2.26 |
| 3     | -4.39<br>(-1.73) | 0.58<br>(3.08) | 0.75<br>(3.10)              | -0.11<br>(-0.90) |                |                   | -0.49<br>(-3.24)         | 0.53<br>(3.66)      | 0.81  | 2.32 |
| 4     | 0.13<br>(0.08)   | 0.66<br>(4.80) | 0.45<br>(2.84)              | -0.11<br>(-1.17) | 0.03<br>(5.66) | -0.08<br>(-0.63)  |                          |                     | 0.92  | 2.58 |

*Note* Figures in the parentheses indicate  $t$  values of the estimated coefficients

price of kharif coarse cereals ranged from 0.28 to 0.36 under alternative specifications. Keeping the other factors constant, a decrease in the domestic price of kharif coarse cereals would lead the farmers to divert area from coarse cereals to other crops. The price of kharif coarse cereals remained to be statistically significant in influencing the area when deflated by competing crop price (with an area elasticity of 0.32). But our estimates of price elasticity of area are much higher than that estimated by Mythili (2006) and Kumar (1998). A good rainfall also has a positive impact on the farmers to bring in more area under kharif coarse cereals. However, irrigation did not have any significant impact on expanding the area under kharif coarse cereal.

The yield response estimates for kharif coarse cereals signify that an increase in the prices of kharif coarse cereals will encourage the farmers to adopt appropriate methods to increase their yield. The relative prices of kharif coarse cereals with respect to input prices would also lead to an increase in yield. Fertilizer use also has the expected positive sign in the yield response of kharif coarse cereals. A decrease in real fertilizer price would also increase the yield of kharif coarse cereals. Kumar (1998) also found such relationship in the case of maize. Hence, a policy ensuring a higher price to the farmers and reduced fertilizer price would increase the yield of the kharif coarse cereals.

The area and yield response equations for rabi coarse cereals are presented in Tables 5.7 and 5.8, respectively. The negative and statistically significant coefficients of competing crop price signifies that an increase in the prices of competing crops would lead to a shift from rabi coarse cereals to the competing crops, especially to wheat. The elasticity of area with respect to price of competing crops is quite high, ranging from 0.09 to 0.30 depending on the alternative specifications of the equations. However, an increase in its own price of rabi coarse cereals would not lead to their area expansion. Non-price factors, namely irrigation and post-monsoon rainfall, have an insignificant impact on the areas of rabi coarse cereals. Yield equations for rabi coarse cereals in Table 5.8. reveal that yield is highly responsive to the own price of rabi coarse cereals with price elasticities hovering around 0.17 across various specifications. In fact, comparing the price elasticity of yield of kharif coarse cereals, it can be observed that yield of rabi coarse cereals is more responsive to prices than kharif coarse cereals. The table also reveals that unlike the kharif coarse cereals, irrigation plays a major role in enhancing the yield of rabi coarse cereals. This is important given the fact that rabi coarse cereals have comparatively much higher proportion of area irrigated than that of kharif coarse cereals. The price variables also play important role in increasing the yield of rabi coarse cereals.

**Table 5.7** Area response for rabi coarse cereals (for the periods from 1980–81 to 2013–14)

| Model | Constant       | Real domestic Price(-1) | Real competing crop price(-1) | Price deflated by fertilizer price(-1) | Fertilizer use   | Irrigation       | Trend             | Rainfall (Oct–Dec) | Irrigation (wheat) | R <sup>2</sup> | DW   |
|-------|----------------|-------------------------|-------------------------------|----------------------------------------|------------------|------------------|-------------------|--------------------|--------------------|----------------|------|
| 1     | 3.32<br>(3.24) | 0.17<br>(1.58)          | -0.31<br>(-1.82)              |                                        |                  | -0.28<br>(-1.22) | -0.006<br>(-1.58) | 0.04<br>(1.25)     |                    | 0.78           | 1.74 |
| 2     | 2.27<br>(4.10) | 0.17<br>(1.55)          | -0.33<br>(-1.94)              |                                        |                  |                  | -0.01<br>(-7.71)  | 0.06<br>(1.91)     |                    | 0.78           | 1.73 |
| 3     | 2.38<br>(4.14) | 0.17<br>(1.56)          | -0.30<br>(-1.72)              |                                        | -0.07<br>(-0.78) | 0.06<br>(1.96)   | -0.007<br>(-1.93) |                    |                    | 0.77           | 1.77 |
| 4     | 3.36<br>(3.25) | 0.17<br>(1.58)          | -0.28<br>(-1.63)              |                                        | -0.06<br>(-0.68) | -0.27<br>(-1.14) | -0.003<br>(-0.74) | 0.05<br>(1.32)     |                    | 0.77           | 1.76 |
| 5     | 3.32<br>(3.24) | 0.17<br>(1.58)          | -0.31<br>(-1.82)              |                                        |                  | -0.28<br>(-1.22) | -0.006<br>(1.58)  | 0.04<br>(1.25)     |                    | 0.78           | 1.74 |
| 6     | 3.43<br>(3.23) |                         | -0.09<br>(-0.73)              | -0.03<br>(-0.52)                       |                  | -0.26<br>(-1.07) | -0.003<br>(-0.91) | 0.03<br>(0.86)     |                    | 0.76           | 1.69 |

Note Figures in the parentheses indicate *t* values of the estimated coefficients

**Table 5.8** Yield response for rabi coarse cereals (for the periods from 1980–81 to 2013–14)

| Model | Constant         | Real domestic price | Price deflated by fertilizer price | Irrigation     | Fertilizer use | Rainfall (Jan–Feb) | Lagged dependent | Trend          | $R^2$ | DW   |
|-------|------------------|---------------------|------------------------------------|----------------|----------------|--------------------|------------------|----------------|-------|------|
| 1     | -3.43<br>(-3.20) | 0.50<br>(3.15)      |                                    | 0.93<br>(2.95) | 0.02<br>(0.17) | 0.02<br>(0.39)     | 0.44<br>(3.19)   |                | 0.95  | 2.28 |
| 2     | -3.53<br>(-4.14) | 0.50<br>(3.22)      |                                    | 0.97<br>(4.07) |                | 0.02<br>(0.39)     | 0.45<br>(3.49)   |                | 0.95  | 2.31 |
| 3     | -1.13<br>(-1.36) | 0.41<br>(2.34)      |                                    |                | 0.27<br>(2.39) | 0.005<br>(0.09)    | 0.61<br>(4.22)   |                | 0.93  | 2.13 |
| 4     | 0.75<br>(1.35)   |                     | 0.30<br>(2.40)                     |                | 0.05<br>(0.39) | 0.03<br>(0.48)     | 0.68<br>(5.21)   |                | 0.93  | 2.13 |
| 5     | -0.37<br>(-0.51) |                     | 0.25<br>(2.41)                     | 0.57<br>(2.12) |                | 0.04<br>(0.77)     | 0.55<br>(4.38)   |                | 0.94  | 2.07 |
| 6     | -1.72<br>(-0.94) | 0.78<br>(5.68)      |                                    | 0.81<br>(1.96) |                | -0.003<br>(-0.06)  |                  | 0.01<br>(2.16) | 0.94  | 1.58 |

*Note* Figures in the parentheses indicate  $t$  values of the estimated coefficients

## 5.5 Summary and Conclusion

This chapter captures the supply response in terms of area and yield at the all-India level for the period 1980–81 to 2013–14. Among the determinants of crop area, various price and non-price factors were tried. Among the price factors, real farm harvest price of own crop was most significant with a positive sign and the competing crop (real) price was significant with a negative sign. In certain cases, fertilizer real price rather than competing crop price was significant. Among the non-price factors, rainfall was significant with a positive sign in almost all the crops. It is, however, mentioned here that different rainfall indicators, for example annual, monsoon, post monsoon or winter, were used in different crops depending on their sowing season falling in different months. Irrigation was found positive and significant only in wheat, rice and rabi coarse cereals. The kharif coarse cereals presented a case of being rainfed crops, wherein the irrigation coefficient was mostly insignificant and even had a negative sign. The lagged dependent variable was most significant with a positive sign indicating the influence of past behaviour on the future decisions of the farmers. Our results corroborate the recent literature indicating non-price factors, especially irrigation being more prominent in farmers' acreage decision than the price factors. Especially in the case of coarse grains, price factors were not the driving force for bringing in more area under the cultivation. Area of these rainfed crops mainly depended on weather factors represented by rainfall.

Yield determinants were somewhat similar to that of area determinants. Own real price had a significant coefficient with a positive sign in wheat and coarse grains implying that profitability motive does influence yield through input usage and management. Rainfall was most significant with a positive sign indicating the climate factor. Fertilizer use per hectare was highly significant with a positive sign indicating the changing contours of Indian agriculture which further infers that fertilizer price subsidies might help to encourage the farmers to attain higher yield. In the case of price factor, it was observed that against rice, higher price of wheat motivated the farmers more to achieve better yield. Similar to wheat, it was observed that a policy ensuring a higher price to the farmers and reduced fertilizer price would increase the yield of the coarse cereals as well. In the case of kharif coarse cereals, yield depends largely on non-price and technological factors like rainfall and irrigation. Though rabi coarse cereals are also grown in rainfed conditions, higher yield can be appropriated under better irrigation facilities and with good rainfall. The positive effect of irrigation on yield indicates that although these crops can be grown with rain water, but if there is some provision of irrigation it would have a positive effect on the yield.

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# Chapter 6

## Analysis of Rice Productivity and Sources of Growth in India

Elumalai Kannan

### 6.1 Background

Despite the recent wave of crop diversification and commercialisation, rice continues to occupy an important place in India's agricultural economy. Rice accounted for over one-fifth of total cropped area and one-sixth of total value of output from the agricultural sector. Rice is an important staple crop, and it provides employment and income to rural households. Various studies show that consumption of cereals including rice has declined over time with increase in per capita income and changes in lifestyle. Nevertheless, rice remains a major source of calorie for a vast majority of population in rural and urban India (Sarma and Gandhi 1990; Chand 2007; Kumar et al. 2011; Ganesh-Kumar et al. 2012). It has been shown that rise in farm productivity puts downward pressure on price of food benefitting the poor in rural areas and also contributes significantly to reduction of poverty (Datt and Ravallion 1998). Increased domestic availability of rice has in fact helped to control the consumer price since the 1970s and became accessible to the poor for adequate consumption. Rice indeed has played a significant role in overcoming the problem of food insecurity in India.

On the rice production front, India has done remarkably well with the advent of Green Revolution technology in the late 1960s. Favourable policy environment for supply of inputs and procurement of paddy enabled the farmers to adopt improved rice production technologies. Inputs such as fertilisers, seed, irrigation, credit and electricity were supplied at subsidised rate. Public investment in research and

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development, and irrigation was stepped up. Government had also set up a mechanism to provide price security in the form of minimum support price and market security through procurement agencies to purchase foodgrains and then supply to the public distribution system for meeting food requirements of the poor. All these measures led to increase in production of rice by almost three times from 37.0 million tonnes in 1968/69 to 104.4 million tonnes in 2012/3. Further, rice area expanded to even non-traditional areas such as Punjab, which registered the highest paddy productivity of about 4.0 tonnes/ha (Government of India 2014).

However, the impressive growth in rice production in the 1980s had set complacency about the ability of Green Revolution technology to meet the future needs of staple food. There were concerns about the slowdown in yield of major crops including rice during the 1990s. Various studies have shown that the total factor productivity growth of rice in major producing states had decelerated in the 1990s (Evenson et al. 1999; Murgai 2005; Kumar et al. 2004, 2008; Chand et al. 2011). Concerns have also been expressed among researchers and policy planners that income from crop cultivation has declined and agriculture is turning out to be non-remunerative. This also assumes great significance from the findings of the Government of India (2005) that 27% of farmers did not like farming as it was not profitable and 40% would quit if they were given a choice of some other occupation.

Although there was reported revival of growth in agricultural sector since the mid-2000s, improvement in yield of major crops such as rice was not remarkable as it was recorded in the 1980s. In fact, it is shown that the agricultural sector showed higher variability in production since the 1990s (Chand et al. 2015; Sen 2016) and its sources of growth (BIRTHAL et al. 2014). Studies have also shown that diversification (area shift) and output price are important drivers of output growth in recent years (Joshi et al. 2007; BIRTHAL et al. 2014). However, such a growth pattern may not be sustainable in the long term unless growth in the total factor productivity is improved through innovation as well as efficiency in inputs use. But, analysis of sources of productivity growth has not received adequate attention among researchers, except Bhushan (2005) and Suresh (2013). The present study analyses temporal pattern in rice production and its sources of growth in India.

The chapter is organised as follows. The next section discusses the data sources and methodology. Changing pattern in rice production and productivity is presented in the third section, and source of paddy output growth is discussed in the fourth section. Fifth section analyses regional variation in cost and income from paddy cultivation. Analysis of technical efficiency and total factor productivity growth in rice is presented in the sixth section, and concluding remarks are made in the final section.

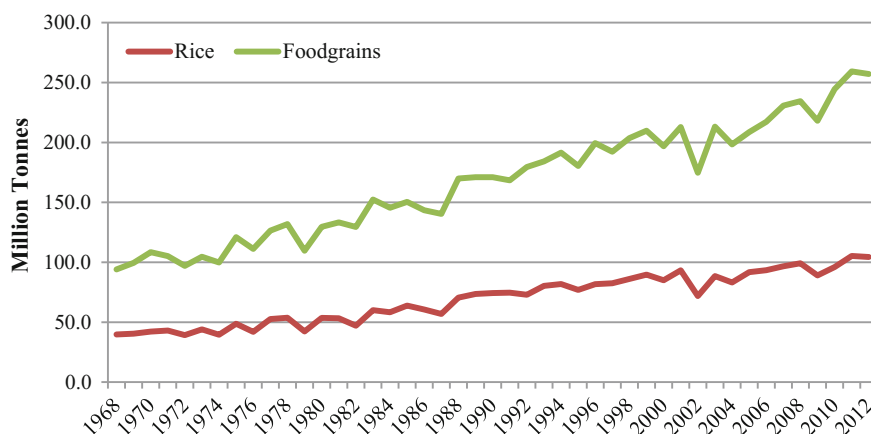
## 6.2 Data and Methodology

Data on area, production and yield were compiled from various issues of *Agricultural Statistics at a Glance* published by the Ministry of Agriculture, Government of India. Data on inputs, output and prices were collected from the *Cost of Cultivation of Principal Crops in India* brought out by the Ministry of Agriculture, Government of India. Consistent data on cost of cultivation were available for 10 major rice-growing states for the period 1990/1–2012/3, and hence, analysis has been restricted to these states. These states accounted for about 83% of the total area under paddy during 2010/1–2012/3. Other relevant information on rice yield gap and productivity at district level was compiled from various published reports.

While the study primarily uses data envelopment analysis to decompose the sources of productivity growth into technical change (innovation) and technical efficiency change (catching up effect), it also employs the traditional decomposition method proposed by Minhas and Vaidyanathan (1965) for identifying the sources of output growth as area effect, yield effect and interaction effect. The technical details of data development analysis used for estimating the total factor productivity (TFP) growth are provided in Annexure. For the Minhas and Vaidyanathan decomposition method, three-year average values of area and yield at base and terminal years were used.

## 6.3 Changing Pattern in Rice Production and Productivity

Achieving food security and stabilisation of food prices were the most important priorities for the Indian government during the 1950s and early 1960s. Introduction of dwarf varieties of wheat from the International Maize and Wheat Improvement Centre (CIMMYT) and high-yielding varieties of rice from the International Rice Research Institute (IRRI) was a important landmark in the history of Indian agriculture. Farmers in different regions of the country had responded positively to adopt these high-yielding varieties along with improved inputs and agronomic practices. These developments had resulted in threefold increase in food production between the 1960s and 2000s and helped to transform the country from the state of food deficit to food surplus at the macrolevel. Among cereals, paddy is an important staple crop, and it is grown in almost all the regions and by different sections of farming community. Paddy constitutes about 40% of total foodgrains production, and its production performance influences overall trend in foodgrains production (Fig. 6.1). Except drought years, paddy production has consistently showed increasing trend over time. In fact, paddy production increased from 40 million tonnes in 1968/9 to 54 million tonnes in 1980/1 and then almost doubled to reach 104 million tonnes in 2012/3. While paddy area increased only marginally from 37 million ha in 1968/9 to 42 million ha in 2012/3, rise in yield was highly



**Fig. 6.1** Trend in production of rice and foodgrains in India. *Source* Government of India (2014)

**Table 6.1** Average annual growth in area, production and yield of rice in India (%)

| Period             | Area  | Production | Yield |
|--------------------|-------|------------|-------|
| 1980–81 to 1989–90 | 0.65  | 4.32       | 3.35  |
| 1990–91 to 1999–00 | 0.70  | 2.09       | 1.36  |
| 2000–01 to 2012–13 | –0.40 | 1.80       | 1.99  |

*Source* Government of India (2014)

commendable. In fact, paddy yield has almost doubled from 1.1 tonnes to 2.5 tonnes/ha between these periods.

Analysis of growth performance of paddy across sub-periods provides very useful results. Various studies showed that India's agricultural sector registered impressive growth during the 1980s due to diffusion of Green Revolution technology in all the regions including those did not gain during the initial years of introduction of new technology (Bhalla and Singh 2001). High-yielding varieties of rice were initially introduced in canal irrigated regions and later spread to other parts particularly in groundwater irrigated areas. Since modern varieties were suitable for cultivation in irrigated regions, the potential of rice production in rainfed areas remains underutilised (Barah 2005). Notwithstanding, paddy production registered a splendid annual growth of 4.32% during 1980/1–1989/0 (Table 6.1). Higher growth in yield at 3.35% contributed to overall production of paddy during this period. However, with more or less stagnant growth in area, fall in yield during 1990/1–1999/0 led to decline in production of rice. The period of 1990s did not bode well for agricultural sector as a whole due to shift in policy direction towards to industrialisation through economic reforms with a thrust on reallocation of resources at macrolevel and consequent decline in public investment in agriculture. Although yield of paddy showed revival in growth during 2000/1–2012/3, negative growth in area led to fall in production.

**Table 6.2** Average annual growth in area, production and yield of rice by major states (%)

| States         | 1990–91 to 1999–00 |            |       | 2000–01 to 2012–13 |            |       |
|----------------|--------------------|------------|-------|--------------------|------------|-------|
|                | Area               | Production | Yield | Area               | Production | Yield |
| Andhra Pradesh | 0.48               | 2.35       | 1.38  | 0.71               | 2.64       | 1.68  |
| Assam          | 0.73               | 2.04       | 1.23  | –0.38              | 2.73       | 2.92  |
| Bihar          | –0.71              | 11.59      | 12.10 | –2.57              | 8.21       | 8.79  |
| Haryana        | 5.82               | 4.64       | –0.58 | 1.07               | 3.60       | 2.77  |
| Karnataka      | 2.47               | 5.11       | 2.54  | –0.46              | 2.26       | 1.74  |
| Madhya Pradesh | 0.51               | 2.16       | 1.70  | 0.47               | 7.28       | 6.71  |
| Orissa         | 0.51               | 2.02       | 1.27  | –0.99              | 8.35       | 8.63  |
| Punjab         | 2.93               | 3.47       | 0.56  | 0.71               | 2.16       | 1.44  |
| Tamil Nadu     | 2.02               | 4.17       | 1.90  | –1.82              | –0.61      | –0.12 |
| Uttar Pradesh  | 0.92               | 3.15       | 2.23  | 0.09               | 2.21       | 1.50  |
| West Bengal    | 0.65               | 3.25       | 2.65  | –0.71              | 1.00       | 1.67  |

Source Government of India (2014)

At the state level, growth performance of paddy appears to be slightly uneven. All the major states showed positive growth in production during the 1990s (Table 6.2). The highest annual growth in paddy production was registered in Bihar due to impressive growth in yield. Despite negative growth in yield in Haryana, higher growth in area led to register a spectacular growth of 4.64% in production. Karnataka also registered relatively a high growth in production, which was more or less equally contributed by area and yield. Among states, West Bengal recorded appreciable growth in yield at 2.65% in the 1990s, but unfortunately it declined to 1.67% during 2000/1–2012/3. Fall in yield and negative growth in area led to low growth in production of paddy at meagre 1.0%. As compared to the period of the 1990s, except Andhra Pradesh other states showed decline in paddy area during the 2000s. Tamil Nadu registered negative growth in area, production and yield. Rate of decline in yield seems to be higher than that of area. However, eastern states such as Assam, Bihar and Orissa showed impressive growth in yield during the recent period.

Analysis of growth performance at the state level masks the existence of wide disparity in rice productivity within states. There are progressive and lagging regions within states that are historically being left out of the development process due to policy bias towards the natural resource-endowed regions. Classification of districts based on rice productivity groups by major states is presented in Table 6.3. All the districts in Punjab registered rice productivity with more than 2.5 tonnes/ha. Most districts in Tamil Nadu and Haryana fell under high productivity category. However, inter-district variation in rice productivity was observed higher in Madhya Pradesh, Bihar and Orissa. Out of 44 rice-growing districts in Madhya Pradesh, 40 districts fell under the low-rice productivity category with average yield less than 1.5 tonnes/ha. These districts accounted for 98.7% of total paddy area and 96.9% of total production in the state. It implies that there exists a great potential to

**Table 6.3** Classification of rice-growing districts based on productivity groups: 2002–03 to 2006–07

| States         | High productivity (>2.5 ton/ha) |                |                      | Medium productivity (1.5–2.5 ton/ha) |                |                      | Low productivity (< 1.5 ton/ha) |                |                      |
|----------------|---------------------------------|----------------|----------------------|--------------------------------------|----------------|----------------------|---------------------------------|----------------|----------------------|
|                | No. of districts                | Area share (%) | Production share (%) | No. of districts                     | Area share (%) | Production share (%) | No. of districts                | Area share (%) | Production share (%) |
| Andhra Pradesh | 14                              | 78.10          | 83.26                | 8                                    | 21.90          | 16.74                | –                               | –              | –                    |
| Assam          | –                               | –              | –                    | 12                                   | 44.63          | 53.41                | 14                              | 55.37          | 46.59                |
| Bihar          | 1                               | 5.48           | 10.98                | 9                                    | 20.38          | 29.67                | 28                              | 74.14          | 59.35                |
| Haryana        | 12                              | 77.70          | 82.80                | 7                                    | 22.30          | 17.10                | –                               | –              | –                    |
| Karnataka      | 11                              | 36.97          | 47.99                | 12                                   | 51.76          | 46.81                | 4                               | 11.26          | 5.20                 |
| Madhya Pradesh | –                               | –              | –                    | 4                                    | 1.31           | 3.15                 | 40                              | 98.68          | 96.85                |
| Orissa         | –                               | –              | –                    | 8                                    | 25.85          | 31.70                | 22                              | 74.15          | 68.30                |
| Punjab         | 19                              | 100.00         | 100.00               | –                                    | –              | –                    | –                               | –              | –                    |
| Tamil Nadu     | 25                              | 71.55          | 80.34                | 4                                    | 28.45          | 19.66                | –                               | –              | –                    |
| Uttar Pradesh  | 5                               | 4.78           | 6.24                 | 56                                   | 90.46          | 90.86                | 9                               | 4.76           | 2.90                 |
| West Bengal    | 8                               | 49.38          | 55.40                | 10                                   | 50.62          | 44.60                | –                               | –              | –                    |

Source Computed from Government of India (2009)

improve rice production through adoption of new technology and provision of proper incentives to farmers.

In Bihar, 28 districts came under low productivity category, and they constituted 74.14% of paddy area and 59.35% of total production. In Orissa, 22 districts registered rice productivity with less than 1.5 tonnes/ha. Similarly, in Assam 14 districts fell under low productivity category. These low productive districts are in rainfed rice ecosystem and lack appropriate production technologies. Since farmers in rainfed rice ecosystem face uncertain production conditions and also market discrimination, they do not have incentives to make adequate investment in farm production technologies. These conditions lead to low input–low output production system, which tend to perpetuate poverty among farmers in rainfed areas (Barah 2005).

## 6.4 Sources of Output Growth

Crop output is basically estimated as the product of area and yield. This simplistic framework implies that any increase or decrease in production depends upon relative change in area and relative change in yield. Minhas and Vaidyanathan (1965) proposed a decomposition method, which decomposes the output growth into contribution of area effect, yield effect and interaction effect. Table 6.4 presents the sources of paddy output growth by major states. At all-India level, both area effect

**Table 6.4** Sources of output growth by major states (%)

| States         | 1990s       |              |                    | 2000s       |              |                    |
|----------------|-------------|--------------|--------------------|-------------|--------------|--------------------|
|                | Area effect | Yield effect | Interaction effect | Area effect | Yield effect | Interaction effect |
| Andhra Pradesh | 19.13       | 79.13        | 1.74               | 56.12       | 38.30        | 5.57               |
| Assam          | 2.82        | 96.98        | 0.20               | −6.90       | 108.71       | −1.81              |
| Bihar          | 2.95        | 93.84        | 3.20               | −114.17     | 244.48       | −30.31             |
| Haryana        | 141.11      | −26.76       | −14.35             | 56.43       | 35.24        | 8.34               |
| Karnataka      | 45.49       | 48.43        | 6.07               | 19.55       | 77.06        | 3.38               |
| Madhya Pradesh | −312.10     | 390.54       | 21.56              | −1.27       | 102.34       | −1.07              |
| Orissa         | −38.36      | 136.82       | 1.54               | −21.69      | 131.16       | −9.47              |
| Punjab         | 94.96       | 4.19         | 0.84               | 51.69       | 43.38        | 4.93               |
| Tamil Nadu     | 53.79       | 38.00        | 8.21               | 62.67       | 52.00        | −14.67             |
| Uttar Pradesh  | 26.90       | 68.44        | 4.66               | 8.50        | 90.07        | 1.43               |
| West Bengal    | 22.14       | 74.70        | 3.16               | −568.93     | 733.37       | −64.44             |
| India          | 30.21       | 66.49        | 3.30               | −5.13       | 106.36       | −1.23              |

Source Computed from Government of India (2014)

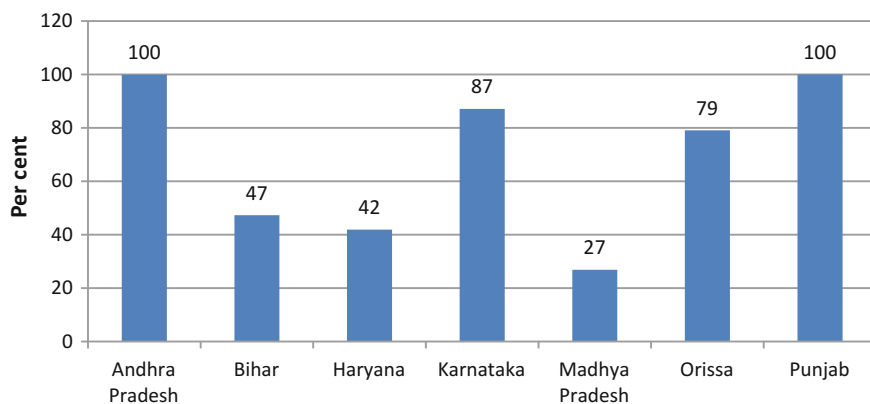
and yield effect contributed to output growth during the 1990s with the dominance of yield effect. During the 2000s, significance of yield effect as a source of output growth was prominent with negative area effect. Sources of output growth across states revealed a mixed pattern. In the high productive state like Punjab, while area effect contributed quite significantly to output growth during the 1990s, both effects played an important role during the 2000s. Similar pattern could be observed in Haryana as well. In the low productive states such as Assam, Bihar, Madhya Pradesh and Orissa, yield was the major source of output growth. Area effect was either negative or low in contributing to output growth.

Although the above-mentioned decomposition method has been widely used by researchers, conclusions drawn based on the results may be misleading (Alauddin and Tisdell 1986). This method assumes change in yield is the indicator of technological progress. However, yield may increase even in the absence of technological progress, and further technological progress may contribute to increased production but yield may remain unchanged or even decline (Alauddin and Tisdell 1986, p. 363). The recent developments in methodological approach such as distance function-based Malmquist productivity index allow decomposition of productivity growth into technical change and technical efficiency change. Results of this decomposition analysis have been presented in the subsequent section, and they offer very useful direction for appropriate policy interventions.

Use of high-yielding varieties along with application of chemical fertilisers in the irrigated conditions helped to increase the production of paddy significantly over time. Adoption of modern varieties progressed much faster in irrigated regions because of their suitability and higher returns from cultivation. However, the level of adoption of high-yielding varieties (HYVs) is quite varied across the states as per the data available for major rice-growing states (Fig. 6.2). Andhra Pradesh and Punjab registered 100% area under the HYVs. The spread of HYVs was 87 and 79% in Karnataka and Orissa, respectively. Adoption of modern varieties was less than 50% of the area under paddy in Madhya Pradesh, Haryana and Bihar. Low adoption of modern varieties is one of the reasons for recording low productivity of rice in these states. Promotion of suitable modern varieties with proper institutional mechanisms for supply of inputs and marketing facilities tends to encourage farmers to adopt improved cultivation practices, which in turn, were found to have positive effect on improving their livelihoods (Prahladachar 1983; Hazell and Ramasamy 1991).

Besides slow spread of modern varieties of rice, various studies expressed concerns about gap in the yield levels between farmers' field and that of experimental station. Singh (2012) estimated the yield gap between improved variety of rice in farmers' field and check variety at demonstration plot. As per estimate of this study, yield gap was lowest at 4% in West Bengal and highest at 41% in Assam. Yield gap in Uttar Pradesh was as high as 33%. Surprisingly, in the high productive state such as Tamil Nadu, yield gap was estimated at 27%. It was 18% in Karnataka and 15% in Andhra Pradesh. Yield gap was relatively low at 13% in Bihar. It can be inferred from that analysis that there is great potential to enhance production of paddy by bridging the yield gap through effective extension services for transfer of technology and public investment in irrigation infrastructure.





**Fig. 6.2** Area under HYV (%). *Source* Government of India (2014)

## 6.5 Regional Variations in Cost and Income

This section presents regional variations in real cost and income from rice cultivation. To compute per hectare farm business income, both inputs and output data were deflated by relevant price deflators at 2004/5 prices. The present study estimates the farm business income as the difference between paid-out cost and gross value of output. Paid-out cost is widely used for analytical purpose to track the changes in the welfare of farmers, and it includes all actual expenses in cash and kind incurred by cultivators and rent paid for leased in land. A weighted state-level income series was constructed by using area share of crops in total cropped area as weight.

Trend in average real cost, output and income is presented in Table 6.5. Cultivation of rice is highly profitable in Punjab with average farm business income of Rs. 24,168 per ha during 2000/1–2012/3. Although paid-out cost has marginally increased between 1990/1–1999/0 and 2000/1–2012/3, more than proportionate increase in the value of output has led to higher growth in farm business income. Average income from rice cultivation was the second highest in Haryana with Rs. 23,585 per ha during the recent period. Gross value of output registered a trend annual growth rate of 2.16% and paid-out cost declined by 0.85%. In Andhra Pradesh, average income has increased from Rs. 14,003 to Rs. 17,757 per ha between 1990/1–1999/0 and 2000/1–2012/3. Both gross value of output and paid-out cost registered a relatively high growth rate during 2000/1–2012/3 as compared to 1990/1–1999/0. Although average farm business income has increased in absolute terms, its growth has actually decelerated during the 2000s as compared to the 1990s. Uttar Pradesh and Madhya Pradesh showed improvement in average income from paddy cultivation overtime.

**Table 6.5** Growth in real cost, output and income from paddy cultivation

| Period                    | Average value (Rs./ha) |                       |                      | Annual growth rate (%) |                       |                      |
|---------------------------|------------------------|-----------------------|----------------------|------------------------|-----------------------|----------------------|
|                           | Paid-out cost          | Gross value of output | Farm business income | Paid-out cost          | Gross value of output | Farm business income |
| <i>Andhra Pradesh</i>     |                        |                       |                      |                        |                       |                      |
| 1990–91 to 1999–00        | 13,972                 | 27,975                | 14,003               | 0.79                   | 1.69                  | 2.81                 |
| 2000–01 to 2012–13        | 16,824                 | 34,581                | 17,757               | 1.09                   | 1.85                  | 2.62                 |
| <i>Assam</i>              |                        |                       |                      |                        |                       |                      |
| 1990–91 to 1999–00        | 4,260                  | 12,754                | 8,494                | 2.10                   | 1.92                  | 1.82                 |
| 2000–01 to 2012–13        | 6,411                  | 13,332                | 6,921                | 1.50                   | 0.12                  | –1.52                |
| <i>Bihar</i>              |                        |                       |                      |                        |                       |                      |
| 1990–91 to 1999–00        | 5,709                  | 12,975                | 7,266                | 2.48                   | 2.02                  | 1.62                 |
| 2000–01 to 2012–13        | 7,639                  | 13,856                | 6,218                | 0.91                   | 1.68                  | 2.43                 |
| <i>Haryana</i>            |                        |                       |                      |                        |                       |                      |
| 1990–91 to 1999–00        | 11,477                 | 27,874                | 16,397               | 0.13                   | –2.06                 | –3.58                |
| 2000–01 to 2012–13        | 14,650                 | 38,234                | 23,585               | –0.85                  | 2.16                  | 4.13                 |
| <i>Karnataka</i>          |                        |                       |                      |                        |                       |                      |
| 1990–91 to 1999–00        | 11,716                 | 29,590                | 17,874               | 4.39                   | 3.07                  | 2.21                 |
| 2000–01 to 2012–13        | 17,177                 | 34,168                | 16,991               | –1.62                  | 0.66                  | 3.14                 |
| <i>Madhya Pradesh</i>     |                        |                       |                      |                        |                       |                      |
| 1990–91 to 1999–00        | 5,675                  | 11,856                | 6,181                | 2.77                   | 2.11                  | 1.34                 |
| 2000–01 to 2012–13        | 6,594                  | 13,996                | 7,402                | 1.50                   | 7.94                  | 15.86                |
| <i>Orissa</i>             |                        |                       |                      |                        |                       |                      |
| 1990–91 to 1999–00        | 6,496                  | 15,011                | 8,515                | 1.33                   | –0.59                 | –2.08                |
| 2000–01 to 2012–13        | 9,357                  | 17,513                | 8,156                | 1.10                   | 1.80                  | 2.61                 |
| <i>Punjab</i>             |                        |                       |                      |                        |                       |                      |
| 1990–91 to 1999–00        | 12,874                 | 28,724                | 15,850               | –0.48                  | 0.55                  | 1.43                 |
| 2000–01 to 2012–13        | 15,364                 | 39,533                | 24,168               | –0.56                  | 1.23                  | 2.50                 |
| <i>Uttar Pradesh</i>      |                        |                       |                      |                        |                       |                      |
| 1990–91 to 1999–00        | 7,042                  | 16,556                | 9,514                | –0.59                  | 1.81                  | 3.92                 |
| 2000–01 to 2012–13        | 9,703                  | 21,052                | 11,348               | 1.49                   | 3.79                  | 5.85                 |
| <i>West Bengal</i>        |                        |                       |                      |                        |                       |                      |
| 1990–91 to 1999–00        | 11,408                 | 24,927                | 13,519               | –0.28                  | –0.94                 | –1.51                |
| 2000–01 to 2012–13        | 13,144                 | 22,901                | 9,757                | 1.69                   | 2.36                  | 3.21                 |
| <i>Overall (weighted)</i> |                        |                       |                      |                        |                       |                      |
| 1990–91 to 1999–00        | 8,455                  | 19,028                | 10,573               | 0.77                   | 0.71                  | 0.67                 |
| 2000–01 to 2012–13        | 10,891                 | 22,411                | 11,520               | 1.07                   | 2.85                  | 4.61                 |

Source Government of India (various years)

In Bihar, trend annual growth in per hectare income was higher during the 2000s than in the 1990s due to low base. But, in absolute terms average farm business income has fallen from Rs. 7,266 to Rs. 6,218 between 1990/1–1999/0 and 2000/1–2012/3. Rise in the level of paid-out cost has led to decline in average income per

hectare in Bihar during the recent period. Average per hectare income was the lowest in Bihar. Average income from paddy cultivation has also declined in states such as Assam, Karnataka, Orissa and West Bengal during 2000s as compared to 1990s. West Bengal registered a steep fall in income by 28% between 1990/1–1999/0 and 2000/1–2012/13. Decline in average value of output and increase in average paid-out cost have led to fall in farm business income during the recent period. In Assam, average per hectare income from paddy cultivation has fallen by 19% during the 2000s as compared to the 1990s. Growth in paid-out cost was much higher than value of output, which has caused decline in income during the recent period. Although decline in average income is only marginal in Karnataka and Orissa, rising paid-out cost is worrisome.

Weighted average income of all the states increased from Rs. 10,571 to Rs. 11,520 per ha between 1990/1–1999/0 and 2000/1–2012/13. Although average paid-out cost increased overtime, a more than proportionate increase in value of output has led to increase in farm business income. In fact, value of output registered impressive growth of 2.85% per annum and paid-out cost recorded growth of 1.07% during 2000/1–2012/3. Further, analysis of long-term trend in cost and income during entire period, 1990/1–2012/3, is more revealing (Fig. 6.3). Trend in gross value of output was more or less constant during 1991/2–2000/1 and then showed a moderate increasing trend from 2001/2 to 2006/7. However, gross value of output registered a steep increasing trend from 2007/8 to 2012/3, which may be attributed to favourable policy focus on enhancing public investment, support price and institutional credit in agriculture. Paid-out cost has showed, by and large, increasing trend overtime. However, paid-out cost has risen substantially between 2000/1 and 2006/7, and this increase in cost has led to fall in farm business income during this period.

Analysis of growth in inputs cost used in rice cultivation is provided in Table 6.6. It can be observed that except animal labour and irrigation, use of most other inputs has increased during the past two decades. Growth in use of seeds was positive in all the states except Assam. Growth in use of seeds, perhaps hybrids and other improved varieties was by far the highest with 3.19% in Punjab. Growth in

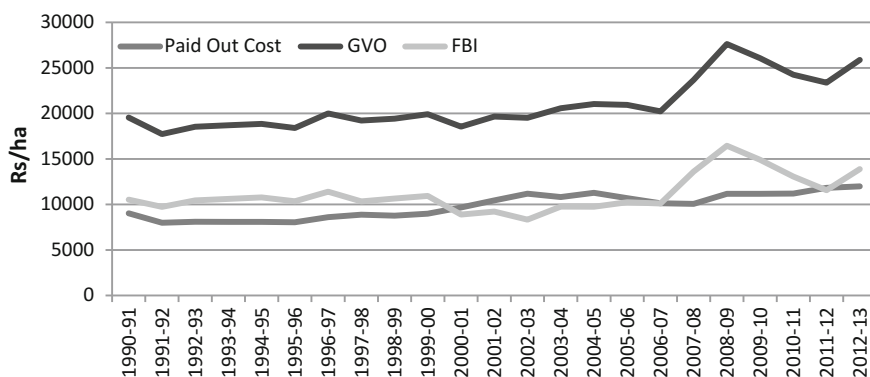


Fig. 6.3 Trend in real cost, output and income

**Table 6.6** Growth in major inputs use in paddy cultivation: 1990–91 to 2012–13 (%)

| States         | Seed  | Fertiliser and manure | Human labour | Animal labour | Machine labour | Insecticides | Irrigation |
|----------------|-------|-----------------------|--------------|---------------|----------------|--------------|------------|
| Andhra Pradesh | 1.23  | −0.02                 | 1.67         | −5.29         | −1.94          | 8.33         | −6.44      |
| Assam          | −3.05 | 9.41                  | 2.56         | 2.10          | 5.67           | 7.88         | 48.95      |
| Bihar          | 0.89  | 2.44                  | 2.59         | −6.25         | 1.88           | 28.28        | 10.87      |
| Haryana        | 2.62  | 0.58                  | 2.10         | −9.83         | −2.82          | 5.19         | −1.69      |
| Karnataka      | 1.99  | 2.26                  | 2.29         | −0.93         | 2.88           | 3.94         | −3.83      |
| Madhya Pradesh | 1.33  | 2.15                  | 2.51         | −1.45         | 3.79           | 15.28        | −1.91      |
| Orissa         | 0.10  | 2.65                  | 6.41         | 1.90          | 5.65           | 6.80         | −0.39      |
| Punjab         | 3.19  | −0.08                 | 1.57         | −4.25         | −4.59          | 7.05         | −4.74      |
| Uttar Pradesh  | 2.51  | 3.39                  | 2.58         | −2.79         | −3.34          | 4.67         | 4.30       |
| West Bengal    | 0.72  | 2.12                  | 2.48         | −1.66         | −0.03          | 5.92         | −0.14      |

Source Government of India (various years)

use of seeds was relatively high in Haryana and Uttar Pradesh as well. In case of fertilisers, most states showed positive growth during 1990/1–2012/3. Negative growth in use of fertilisers in Andhra Pradesh and Punjab is negligible. All the states have registered positive growth in human labour use with highest growth being recorded in Orissa and lowest in Punjab and Andhra Pradesh.

In case of use of agricultural machineries, agriculturally progressive states such as Punjab, Haryana, Andhra Pradesh and Uttar Pradesh have shown negative growth rates. In fact, these states have achieved a higher level of capital intensification, and farmers spend more on replacement cost for the initial capital investment in an attempt to maintain the same level of efficiency. It is clear from the analysis that use of inputs in the cultivation of paddy is increasing and given the fact that key issues are whether input intensification is driving rice output growth? How sustainable is this growth in the long run? A widely used the Total factor productivity growth (TFP) is an important measure of sustainable output growth, and hence, it is important to analyse here the performance of TFP growth in rice sector.

## 6.6 Technical Efficiency and Total Factor Productivity Growth in Rice

In the present chapter, the DEA approach has been used to measure TFP growth and decompose this growth into, technical change, technical efficiency change and scale efficiency change. Overall efficiency change is the product of pure technical efficiency change and scale efficiency change. A major advantage of using of DEA is to identify the sources of growth for appropriate policy suggestions for improving the productivity growth in India's rice sector. Rice yield (quintal/ha) was captured as the output variable. Input variables included seed (kg/ha), fertilisers (kg nutrients/ha), manure (quintal/ha), human labour (man h/ha) and animal labour (pair

**Table 6.7** Technical efficiency and TFP growth in rice

| Period             | TFP growth | Technical change | Technical efficiency change | Pure technical efficiency change | Scale efficiency change |
|--------------------|------------|------------------|-----------------------------|----------------------------------|-------------------------|
| 1991–92 to 1995–96 | 2.27       | 1.73             | 0.53                        | 0.00                             | 0.53                    |
| 1996–97 to 2000–01 | 1.84       | 3.73             | –1.79                       | –0.36                            | –1.45                   |
| 2001–02 to 2005–06 | 4.78       | 2.97             | 1.72                        | 0.39                             | 1.36                    |
| 2006–07 to 2012–13 | 3.98       | 4.23             | –0.24                       | –0.14                            | –0.07                   |
| 1991–92 to 2012–13 | 3.28       | 3.26             | 0.02                        | –0.04                            | 0.08                    |

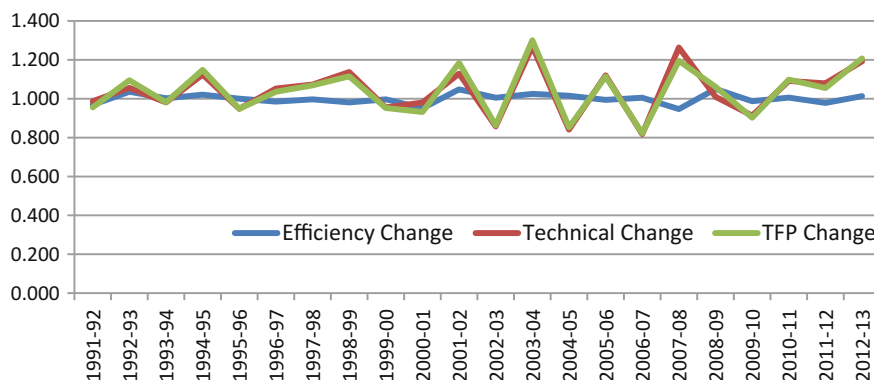
h/ha). In addition, cost of insecticide and irrigation deflated by respective price indices were also included as input variables.

It can be observed from the Table 6.7 that the average TFP growth in rice during 1991/2–2012/3 was 3.28%. Most of the growth in TFP was contributed by growth in technical change. It implies that adoption of new technology by the farmers was very impressive during this period. There was not much improvement in technical efficiency change, but negative growth in pure technical efficiency change. In fact, sub-period analysis shows deterioration in pure technical efficiency gains during 1996/7–2000/1 and 2006/7–2012/3. It implies that there was lack of efficiency gains due to improper application of technology/combination of inputs.

The highest growth in TFP of 4.78% was observed during 2001/2–2005/6, which was contributed by 2.97% in technical change and 1.72% in technical efficiency change. Both frontier effect (technical change) and catching up effect or movement towards best frontier (technical efficiency change) helped to achieve higher TFP growth. Improvement in technical efficiency change was mainly driven by scale efficiency change (1.36%) and pure technical efficiency change (0.39%). However, TFP growth registered the lowest rate of 1.84% during 1996/7–2000/01. Although frontier effect showed impressive growth of 3.73%, negative growth in technical efficiency change pulled down the overall productivity improvements. Deterioration in pure technical efficiency and scale efficiency was observed during this sub-period. TFP growth during the recent most sub-period (2006/7–2012/3) was as high as 3.98%, and it was largely driven growth in technical change. These results broadly indicate that technical change was the main driver of the TFP growth in rice along with low improvement in technical efficiency.

Trend in technical efficiency change, technical change and TFP index for the entire period of analysis is presented in Fig. 6.4. It can be observed that trend in technical efficiency change remained more or less constant except during the mid-1990s and mid-2000s. Further, it is interesting to note that the trend in TFP change has closely followed the movement of technical change. In fact, technical change continued to push the trend in overall productivity steeply during the recent years.

Analysis of spatial and temporal pattern in TFP growth and its components provides more interesting results (Table 6.8). Except Assam, all other states have shown positive growth in TFP from 1991/2 to 2012/3. There was no improvement



**Fig. 6.4** Trend in technical efficiency, technical change and TFP index

in efficiency change, and further technical regression was observed in Assam. Recent efforts to bring technological progress in Eastern India including Assam did not seem to have impacted TFP growth. In nine states, most of the TFP growth was largely contributed by frontier shift resulting from adoption of modern technologies by farmers in rice cultivation. The highest growth in TFP was observed in Punjab (5.71%), largely driven by technical change (5.71%). There was no technical efficiency gains observed in this state. The next highest growth in TFP was recorded in Andhra Pradesh with 5.19%, which was mainly contributed by technical change (4.61%) and also some extent by growth in technical efficiency (0.54%). TFP growth in Haryana, Orissa, Uttar Pradesh, Bihar and Karnataka was 3.88, 2.86, 2.82, 2.78 and 2.64%, respectively. TFP growth in West Bengal was as low as 0.39% from 1991/2 to 2012/3. While frontier shift effect was positive, movement of paddy farmers towards to fully efficient frontier had deteriorated in this state.

Sub-period analysis of TFP growth performance provides mixed results. With no improvement in technical efficiency change, Assam registered negative growth in TFP during the 1990s and 2000s. Madhya Pradesh experienced technical inefficiency as well as technological regression during the 1990s, which resulted in negative TFP growth of 1.49%. But, during the 2000s, there was a turnaround in TFP growth (4.47%) with a significant improvement in technical change (3.98%) and technical efficiency change (0.45%). In West Bengal, negative frontier effect outweighed the positive catching up leading to negative growth in TFP during the 1990s. However, a reversal in their effects with dominance of frontier effect or technological progress led to positive growth in TFP during the 2000s. Similarly, Orissa registered a spectacular performance in TFP growth during the 2000s as compared to the 1990s. Both technical efficiency and technical change have contributed to overall productivity improvements. In case of Andhra Pradesh, it was interesting to observe that technical change became more dominant than technical efficiency change during the 2000s in contributing to TFP growth. Overall, analysis revealed that technical change due to adoption of improved technologies had

**Table 6.8** Technical efficiency and TFP growth across states

| States         | 1991–92 to 1999–00 |                  |            | 2000–01 to 2012–13 |                  |            | 1991–92 to 2012–13 |                  |            |
|----------------|--------------------|------------------|------------|--------------------|------------------|------------|--------------------|------------------|------------|
|                | Efficiency change  | Technical change | TFP growth | Efficiency change  | Technical change | TFP growth | Efficiency change  | Technical change | TFP growth |
| Andhra Pradesh | 1.19               | 2.48             | 3.70       | 0.10               | 6.12             | 6.23       | 0.54               | 4.61             | 5.19       |
| Assam          | 0.00               | -8.09            | -8.09      | 0.00               | -1.59            | -1.59      | 0.00               | -4.30            | -4.30      |
| Bihar          | 0.00               | 4.17             | 4.17       | 0.00               | 1.82             | 1.82       | 0.00               | 2.78             | 2.78       |
| Haryana        | 0.00               | 6.42             | 6.42       | 0.00               | 2.15             | 2.15       | 0.00               | 3.88             | 3.88       |
| Karnataka      | 0.00               | 1.30             | 1.30       | -0.52              | 4.10             | 3.57       | -0.31              | 2.95             | 2.64       |
| Madhya Pradesh | -0.66              | -0.83            | -1.49      | 0.45               | 3.98             | 4.47       | -0.01              | 1.98             | 1.99       |
| Orissa         | -3.23              | 2.84             | -0.47      | 2.45               | 2.71             | 5.22       | 0.09               | 2.77             | 2.86       |
| Punjab         | 0.00               | 11.33            | 11.33      | 0.00               | 1.98             | 1.98       | 0.00               | 5.71             | 5.71       |
| Uttar Pradesh  | 0.00               | 4.43             | 4.43       | 0.00               | 1.72             | 1.72       | 0.00               | 2.82             | 2.82       |
| West Bengal    | 1.13               | -1.35            | -0.26      | -0.97              | 1.83             | 0.85       | -0.12              | 0.52             | 0.39       |

largely contributed to TFP growth. There was little improvement in technical efficiency change in most rice-producing states.

## 6.7 Conclusions

This chapter analysed temporal changes in rice production and its sources of growth. The distance function-based Malmquist productivity index was used to decompose the TFP growth into technical change and technical efficiency change. Paddy constituted about 40% of total foodgrains production, and its production performance tends to influence overall trend in foodgrains production. With the advent of high-yielding varieties technology, paddy production increased remarkably from 40 million tonnes in 1968/9–104 million tonnes in 2012/3. With more or less stagnant area, yield of paddy had almost doubled from 1.1 tonnes to 2.5 tonnes/ha between these periods and seemed to have had significantly contributed to increase in production. From 1980/1 to 1989/0, paddy production registered a splendid annual growth of 4.32% with yield growth of 3.35% per annum. However, fall in yield growth led to decline in production during the 1990s. Although yield of paddy showed revival in growth during 2000–01 to 2012–13, negative growth in area led to decline in production. Growth performance of paddy at the state level showed a mixed pattern.

All the districts in Punjab and most rice-growing districts in Tamil Nadu and Haryana registered rice productivity with more than 2.5 tonnes/ha. However, inter-district variation in rice productivity was observed higher in Madhya Pradesh, Bihar, Orissa and Assam. These low productive districts are in rainfed rice ecosystem and lack appropriate production technologies. There exists a great potential to improve rice production through adoption of suitable modern varieties and institutional mechanism for supply of inputs and provision of marketing facilities.

Adoption of high-yielding varieties (HYVs) was quite varied across the states with 100% area coverage in Andhra Pradesh and Punjab. Adoption of modern varieties was less than 50% of the area in Madhya Pradesh, Haryana and Bihar. Low adoption of modern varieties was one of the reasons for recording low productivity of rice by these states. Further, yield gap was observed lowest at 4% in West Bengal and highest at 41% in Assam. It implies that there is great potential to enhance production of paddy by bridging the yield gap through effective extension services for transfer of technology and public investment in irrigation infrastructure.

At all-India level, weighted average income from paddy cultivation increased from Rs. 10,571 to Rs. 11,520 per ha between 1990/1–1999/0 and 2000/1–2012/13. Although average paid-out cost increased overtime, a more than proportionate increase in value of output had led to increase in farm business income. Analysis of growth in inputs cost revealed that except animal labour and irrigation, use of most other inputs such as seed, fertilisers, pesticides and machine labour had increased overtime.



At all-India level, the average TFP growth for rice was estimated 3.28% during 1991/2 to 2012/3. Most of the growth in TFP was contributed by growth in technical change. There was not much improvement in technical efficiency change, but negative growth in pure technical efficiency change was observed. Except Assam, all other states have shown positive growth in TFP from 1991/2 to 2012/3. Assam showed worsening of frontier shift effect. Punjab registered the highest TFP growth of 5.71% followed by Andhra Pradesh with 5.19%. However, except Andhra Pradesh, other states showed no technical efficiency gains, which means higher amount of paddy is produced by using higher quantity of inputs per hectare. Overall, analysis revealed that technical change was the main driver of the TFP growth in paddy with little improvement in technical efficiency.

## Annexure: Measurement of Total Factor Productivity

Total factor productivity (TFP) is calculated as the ratio of aggregate output to aggregate input. In India, most studies used Tornqvist index for constructing output and input indices by using quantity and price information (Kumar and Mruthynjaya 1992; Evenson et al. 1999; Mukherjee and Yoshimi 2003; Kumar et al. 2004, 2008; Chand et al. 2011). This index has been preferred for its niceties of theoretical properties as established by Diewert (1976, 1978). But, this index is considered to be a descriptive measure of productivity change. Tornqvist index does not allow for decomposition of productivity growth (Färe et al. 1994), and either it requires the knowledge of underlying production technology (Ray 2004, p. 274). Further, TFP growth estimated by using this method is inappropriately interpreted as technical change (Mahadevan 2002). However, distance function-based Malmquist productivity index lends decomposition of productivity growth into technical efficiency change (catch-up) and technical change (innovation) between two time periods. Malmquist productivity index was originally introduced by Caves et al. (1982), and its use in empirical studies was popularised by Färe et al (1994).

Distance function is useful to describe a multi-input, multi-output technology without specifying behavioural objectives of the farmers. To define Malmquist total factor productivity index, the concept of output distance function is used here. The output distance function measures maximal proportional expansion of output vector given input vector. Following Färe et al. (1994), for each time period  $t = 1, 2, \dots, T$ , the production technology set  $S^t$  consists of all feasible input vector  $x^t \in R_+^N$  and output vector  $y^t \in R_+^M$  such that  $x$  can produce  $y$ . The technology set is represented as:

$$S^t = \{(x^t, y^t): x^t \text{ can produce } y^t\}$$

The output distance function defined at  $t$  is as follows.

$$D_0(x^t, y^t) = \min\{\theta: (x^t, y^t/\theta) \in S^t\}$$

$D_0(x^t, y^t)$  represents the distance of a farm using  $x$  input vector to produce  $y$  output vector in period  $t$  relative to the reference technology in period  $t$ . The distance function  $D_0(x^t, y^t)$  will take a value of less than or equal to one if  $(x^t, y^t)$  is an element of technology set  $S^t$ . Further,  $D_0(x^t, y^t)$  will take a value of one if  $(x^t, y^t)$  is located on the boundary of the technology, and it will take a value greater than one if located outside the feasible technology set. Distance function is measured by using Data Envelopment Analysis like linear programming by assuming constant returns to scale (for details see Färe et al. 1994; Coelli 1996; Coelli et al. 1998; Coelli and Prasada Rao 2003).

Under output orientation, Malmquist total factor productivity (TFP) index measures radial distances of observed output between two time periods in relation to a reference technology. Here, Malmquist TFP index measures changes in TFP between two adjacent time periods as the ratio of each output distance relative to a reference technology. Following Färe et al. (1994), Malmquist TFP index between period  $t$  and  $t + 1$  can be represented as geometric mean of output oriented indexes: one using technology in period  $t$  as a reference technology and another using technology frontier in period  $t + 1$  as the reference. The Malmquist TFP index is written as follows.

$$\begin{aligned} M_0(x^{t+1}, y^{t+1}, x^t, y^t) &= [M_0^t(x^{t+1}, y^{t+1}, x^t, y^t) \times M_0^{t+1}(x^{t+1}, y^{t+1}, x^t, y^t)]^{1/2} \\ &= \left[ \frac{D_0^t(x^{t+1}, y^{t+1})}{D_0^t(x^t, y^t)} \times \frac{D_0^{t+1}(x^{t+1}, y^{t+1})}{D_0^{t+1}(x^t, y^t)} \right]^{1/2} \end{aligned}$$

The Malmquist productivity index defined in terms of distance functions above evaluates whether the observed input/output combination has improved relative to reference technology in period  $t$  and reference technology in period  $t + 1$ . The value of productivity index ( $M_0$ ) greater than one will indicate a positive TFP growth, less than one the negative TFP growth and equal to one will show the stagnation in TFP growth between the periods  $t$  and  $t + 1$ . Following Färe et al. (1994), the Malmquist productivity index can be written in the following form.

$$\begin{aligned} M_0(x^{t+1}, y^{t+1}, x^t, y^t) &= \frac{D_0^{t+1}(x^{t+1}, y^{t+1})}{D_0^t(x^t, y^t)} \\ &\times \left[ \left( \frac{D_0^t(x^{t+1}, y^{t+1})}{D_0^{t+1}(x^{t+1}, y^{t+1})} \right) \times \left( \frac{D_0^t(x^t, y^t)}{D_0^{t+1}(x^t, y^t)} \right) \right]^{1/2} \end{aligned}$$

The component outside the square bracket is the ratio of technical efficiency in period  $t$  to technical efficiency in period  $t + 1$ . This efficiency change component indicates how far the observed production is getting closer or farther from frontier. The expression inside the bracket indicates shift in technology frontier (technical change) between the period  $t$  and  $t + 1$ . It is measured as the geometric mean of

shift in technology between two periods evaluated at input levels  $x^t$  and  $x^{t+1}$ . The value of efficiency change component greater than one indicates that the production unit is catching up to the frontier in period  $t + 1$  as compared the period  $t$ . The improvement in technical change provides evidence of innovation between two periods, and the value of technical change greater than one shows technical progress. In other words, TFP growth can be written as,

$$\text{TFP growth} = \frac{\text{Technical Efficiency Change}}{(\text{Catching up effect})} \times \frac{\text{Technical Change}}{(\text{Frontier shift effect})}$$

Following Färe et al. (1994), technical efficiency change can be decomposed into pure technical efficiency change (estimated under variable returns to scale) and scale efficiency change. This can be specified as,

Technical Efficiency Change = Pure Technical Efficiency Change  $\times$  Scale Efficiency Change.

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# Chapter 7

## Changes in Production Structure and Class Composition in Agriculture: An Analysis of Agrarian Question Based on Punjab Experience

Balwinder Singh Tiwana and Paramjit Singh

### 7.1 Introduction

Is capital, and in what ways is capital, taking hold of agriculture, revolutionising it, smashing the old forms of production and of poverty and establishing the new forms which must succeed? This statement by Kautsky (1988) led to an extensive debate on the agrarian question. If one goes into the history, the agrarian question has been deliberated upon in the broader context of Marxian political economy versus standard neoclassical economics, political economy of agrarian change and new institutional economics. The Marxian views on capital-driven transformation of agriculture focused on (a) primitive accumulation that is the historical process of divorcing the producer, particularly the petty producers, from the means of production, thereby creating a class of ‘free’ workers, and (b) internal differentiation of the peasantry that is the expropriation assumes different facets in different countries and runs through its various phases in diverse order of succession, and at different historical epochs. The three broad aspects of agrarian question have been accumulation, production and politics each having implications for agrarian transition. The pattern of capitalist development of an economy can be understood better through an analysis of how these three aspects facilitate or obstruct the agrarian transition.

Taking Punjab as a case study, we deliberate upon these facets with a view to understand the agrarian transition that has been witnessed in the state since the 1960s when the Green Revolution technology was adopted followed by neoliberal policies from 1991. Punjab is an agriculturally developed state in northern India,

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which had the privilege to embark upon the Green Revolution. The study of agrarian question occupied interest during the 1960s when techno-economic solutions were initiated and their relevance were discussed in contrast to the institutional reforms. Economists intensively debated on the mode of production in Indian agricultural. While Rudra et al. (1969) maintained that there were no capitalist farms; Patnaik (1971) purported the development of capitalism in Indian agriculture. The interest in the subject got revived during the 1980s and 1990s when an increasing integration of national economies into global tracks of production, exchange and finance started taking place under the structural adjustment programme and globalisation. Many questions were raised by scholars with regard to the impact of these policy changes on Indian agriculture. The likely impact of neoliberal policies on agriculture became the centre stage of discussion, especially in the developing countries having small land holdings and dependence of a sizeable population on agriculture for livelihood.

Punjab was the first Indian state, which had the privilege to embark upon the Green Revolution technology owing to favourable climatic conditions and natural resource endowments. The adoption of high-yielding varieties under the Green Revolution enabled development of necessary irrigation, market and other physical infrastructure by the government across the state. Consequent upon an increased resource flow and a favourable price support mechanism, crop productivity increased manifold. The class of resource-rich capitalist farmers was consolidated, and a new class of Green Revolution-generated rich capitalist farmers emerged in this state and in Haryana which got the highest benefits from Green Revolution technology. Among many Indian states, Punjab was at the forefront of the international capitalist strategy of increasing material production.

After the end of colonial rule, a period of limited land reforms emerged during the early the 1950s under the national bourgeois State which was in connivance with feudal landlords as a class. During the 1960s, an increase in agricultural production became difficult in the absence of radical bourgeois agrarian reforms. Hence, an imperialist new agricultural strategy named Green Revolution was enthusiastically implemented for increasing farm production without seriously disturbing the production relations. The favourable policies led to a phenomenal growth in cereal production and income, both in terms of total state domestic product and per capita income. The advent of Green Revolution transformed production forces and production relations on a capitalist line. A plethora of studies was undertaken by scholars to examine the socio-economic impact of Green Revolution technology in the state (Johl and Rao 2002). However, questions of internal relations of production and changes in class composition in the countryside were largely neglected in these studies. Over the period, the withdrawal of the state from agrarian affairs in various forms such as decline in investment and input subsidy to agriculture, removal of quantitative restrictions on commodity trade and hence import surge, especially after the implementation of economic reforms since 1991 have given birth to newer questions, linked with the ongoing farm crisis in Punjab.

There is hardly any comprehensive attempt made in the academia to evaluate the changes in the production structure and class composition in rural Punjab. The significance of the agrarian question can be rationalised from the fact that 62.52% of the total population in the state lives in rural areas, out of which 37.25% directly depends on agriculture and the livelihood of the remaining is closely determined by the performance of agriculture (Census of India 2011). The farm crisis started emerging during the 1980s and intensified after the initiation of neoliberal policies at the national level. During the 1990s, the agricultural sector experienced a slowdown in the yield and productivity growth across the country, but more in Punjab. The income and profit margins of the farmers came down drastically. Along with stagnation in production and productivity, an excessive use of market-based inputs has resulted in manifold increase in the cost of production. The overcapitalisation of production process has squeezed the possibilities of new employment in agriculture and has changed the agrarian relations in the countryside.

The principle question that this study has raised is: what type of production structure has emerged after the introduction of the neoliberal policies and the type of production relations that most of rural population has? It seeks to understand the material conditions under which the rural population has been working and the relations in which they pass in due to superimposition of capitalist production structure by state policies. For this, two broad aspects related to agrarian economy are considered. First, changes in the production structure after the introduction of new agricultural strategy and the emerging agrarian crisis. Second, changes in the production relations and class composition due to transformation of production structure.

### ***7.1.1 Changes in the Production Structure***

The agrarian question requires an understanding of the nature, extant and degree of changes in the production structure following the introduction of new methods of cultivation. The changes in production structure in Punjab can be understood through the examination of two important political economic changes at the national level.

- (a) Green Revolution as an imperialist strategy,
- (b) Economic reforms of the 1990s and the crisis of intensive agriculture.

The Green Revolution strategy was promoted by international organisations of developed countries, in particular Ford Foundations and Rockefeller as a policy that would create food abundance in agricultural dominant countries/societies to tackle food shortage along with agrarian conflict. This was based on an intensive use of natural resources along with an intensive use of market-purchased essential inputs such as seeds and fertilizer. This new technology not only changed the production structure but also gave birth to the new links between the state and cultivators, the

international imperialist strategy and local communities and within the agrarian production relations (Shiva 1989). Punjab played an important role in introducing structural and institutional changes as per the requirements of the new strategy. The interventionist role of the State in agriculture was not to solve the agrarian question; rather it was to maintain the dominance of feudal class relations along with the modernisation of production structure. The State intervention can be highlighted from partial implementation of land reforms, increased extension of irrigation facilities, expansion of institutional and non-institutional credit network, building up of transportation network, marketing and storage facilities, investment in agriculture research and development, subsidised inputs, etc. Such incentives played an important role in avoiding class polarisation in rural areas. Their availability kept small peasantry in the agricultural sector. This is one of the fundamental reasons that the process of concentration and centralisation of capital was not that rapid as it was observed by the Marxian scholars in the case of western countries. This controlled accumulation strategy and State incentives had weakened the class conflict and contradictions for two decades after the implementations of new strategy of cultivation.

The successful implementation of new seed-cum-fertilizer technology in the state has weakened the potential revolutionary changes in the political and economic institutions in rural areas. In spite of the widening income and asset gap between the different segments of the peasantry, the gains in the productivity growth, as pointed out by Oasa (1987), were higher which prevented the vested interest of most classes in an evolutionary rather than a revolutionary pattern of rural development. The changes in the production structure were imposed by the imperialist strategy of developed nations, and the domestic bourgeoisie state with feudal character has successfully implemented it. These changes in production structure have transformed the peasants' self-sustaining local production/consumption system into agronomically dependent system upon seeds and inputs produced by big corporates. This market-dependent/-driven production structure that required particular technical farms was heavily dependent upon investment. These requirements forced cultivators to seek loan in order to adopt new technology. These two requirements (one modernisation of agriculture and second requirement of finance) meant that the peasants must reorganise their produce to maintain surplus to pay for market-driven inputs and the interest due on initial loans. These changes in the mode of production have resulted in a shift in production priorities from domestic consumption requirements to market-oriented agriculture.

Overall, this new strategy of crop cultivation has also guided agriculture on capitalist lines. This continued for three decades. The introduction of neoliberal reforms since 1991 has added new dimensions to the specific crisis being faced in Punjab agriculture. The most important changes that were a result of neoliberal reforms were changes in the character of the State from an interventionist to a facilitator. The State, which had played a central role behind the implementations of new agricultural strategy, has withdrawn from the agricultural sector. Second, the technology which was introduced during the 1960s has become outdated and hence the growth of production and productivity of crops has slowed down across the



state. Third, the removal of quantitative and qualitative restrictions under the UR Agreement on Agriculture (AOA) under the auspices of the WTO has reduced the bargaining power of the farmers and agricultural labour unions for price of agricultural commodities. Fourth, the continuous decline in public investment in agriculture under the pressure of international institutions has negatively affected the rural political and socio-economic structure in Punjab.

To reiterate the introduction of the imperialist strategy of intensive cultivation during the 1960s and 1970s along with changes in the character of State and priorities of policies have led to crisis in the agricultural sector. The understanding of agrarian question requires an understanding of the nature, extent and degree of changes in the production structure after the introduction of new methods of cultivation, particularly after the full implementation of the neoliberal reforms. It first requires an analysis of capitalist development in agriculture based on three points.

- (a) Intensification of agriculture, production and productivity growth and stagnation,
- (b) Market-based production techniques and market-oriented production,
- (c) Development of production forces and its implications for employment.

### ***7.1.2 Intensification of Production***

In the last century, the state's geographical boundaries have been shifted twice—the violent Partition of India in 1947 and the administrative division in 1966 into present-day Haryana and Himachal Pradesh. Now, Punjab encompasses the total geographical area of 5,036,000 ha, which constitutes about 1.53% of total geographical area of the country. The development of capitalistic tendencies in Punjab agriculture after the 1960s has resulted in the continuous increase in area under cultivation. Table 7.1 provides the summary of shift in land utilisation pattern after the capitalisation of production process. It shows that out of the total geographical area, more than 82% is the net sown area (Table 7.1).

The commercialisation and market-oriented production have also resulted in the continuous decline in uncultivable and barren land. It was 208,000 ha in 1970–71 and declined to only 51,000 ha in 2012–13. Similarly, the shift in mode of production on capitalist lines has also brought more area that was fallow land under cultivation. The fallow land declined from 313,000 ha in 1960–61 to 110,000 ha in 1990–91; and it further declined to 45,000 ha in 2012–13. The land put to non-agricultural purposes has shown an increasing trend, particularly due to rapid shift in area towards urbanisation.

Table 7.1 also shows that due to the introduction of capital-driven production techniques, the net sown area has also increased from 3,757,000 ha in 1960–61 to 4,218,000 ha in 1990–91; and marginally declined to 4,150,000 ha in 2012–13. The decline in net sown area has been due to the rapid growth of urban area in different parts of the state. The cropped area has also progressed from 4,732,000 to

**Table 7.1** Land utilisation pattern in Punjab (area in 000' ha)

| Items                                   | 1960–61 | 1970–71 | 1980–81 | 1990–91 | 2000–01 | 2012–13 |
|-----------------------------------------|---------|---------|---------|---------|---------|---------|
| Total geographical area                 | 5036    | 5036    | 5036    | 5036    | 5036    | 5036    |
| Area under forests                      | 35      | 123     | 216     | 222     | 280     | 262     |
| Uncultivable barren land                | –       | 208     | 96      | 83      | 28      | 51      |
| Land put for non-agricultural use       | –       | 416     | 436     | 343     | 410     | 486     |
| Uncultivable land excluding fallow land | 255     | 92      | 49      | 57      | –       | 06      |
| Fallow land                             | 313     | 139     | 45      | 110     | 43      | 45      |
| Net sown area                           | 3757    | 4053    | 4191    | 4218    | 4250    | 4150    |
| Cropped area                            | 4732    | 5678    | 6763    | 7502    | 7941    | 7870    |
| Cropping intensity                      | 126     | 140     | 161     | 178     | 186     | 190     |

Source Statistical Abstract of Punjab, various issues

7,870,000 ha between 1960–61 and 2012–13. The cropping intensity has increased from 126 in 1960–61 to 190 in 2012–13, which is supposed to be the maximum. It is apparent that the introduction of capitalistic methods of cultivation has not only helped to increase the area under cultivation, but it has also contributed positively towards the growth in production and productivity during the initial years of the Green Revolution.

### 7.1.3 *Production and Productivity Trends*

It is a well-established fact that after the introduction of new methods of cultivation, the production and productivity of major crops across the state increased very sharply, which in a way boosted the overall economic growth. The productivity of all the crops has increased after the introduction of new methods of cultivation, but the productivity of rice and wheat increased at a much faster rate. Table 7.2 shows that the production of wheat increased from 1244 kg/ha in 1960–61 to 4724 kg/ha in 2012–13. Similarly, the production of rice has also increased from 1009 to 3998 kg/ha during the same period. It is significant to note that within the span of five decades the average productivity of wheat and rice has increased almost four times. The increase in productivity of these two crops was largely due to the minimum support price backed by procurement, availability of high-yielding variety seeds of these two crops through state initiatives and the development of suitable agricultural infrastructure for these crops. However, these initiatives and incentives in favour of market-oriented model of agriculture have negatively affected the cropping pattern in Punjab.

**Table 7.2** Yield of principal crops in Punjab (kg/ha)

| Crops                | 1960–61 | 1970–71 | 1980–81 | 1990–91 | 2000–01 | 2012–13 |
|----------------------|---------|---------|---------|---------|---------|---------|
| Wheat                | 1244    | 2238    | 2730    | 3715    | 4563    | 4724    |
| Rice                 | 1009    | 1765    | 2733    | 3229    | 3506    | 3998    |
| Maize                | 1135    | 1555    | 1602    | 1786    | 2793    | 3680    |
| Barley               | 768     | 7022    | 1640    | 2754    | 3393    | 3863    |
| Gram                 | 813     | 797     | 582     | 744     | 953     | 1245    |
| Bajra                | 472     | 1176    | 1244    | 1107    | 893     | 895     |
| Sugarcane            | 3654    | 4117    | 5526    | 5941    | 6425    | 5888    |
| Cotton (A)           | 269     | 391     | 329     | 481     | 437     | 577     |
| Cotton (D)           | 270     | 338     | 241     | 285     | 408     | 458     |
| Rapeseed and mustard | 505     | 553     | 567     | 1003    | 1218    | 1306    |
| Groundnut            | 925     | 970     | 1249    | 816     | 879     | 1850    |

Source Statistical Abstract of Punjab, various issues

### 7.1.4 From Diversification to Monoculture

It can be seen that prior to the advent of capitalism, the cropping pattern was well diversified which was not only beneficial for the domestic requirements of the farming community but also beneficial for the ecological balance and fertility of the soil. After the introduction of the Green Revolution strategy, the agrarian economy of Punjab shifted from diversification to specialisation. The domestic needs-driven agriculture was transformed into market-oriented agriculture. It can be easily observed from the data shown in Table 7.3. Out of the gross cropped area, wheat and rice constituted nearly about 70% of the total cultivated area. The percentage of net sown area under these two crops has increased quite remarkably after the introduction of new agricultural strategy, whereas the area under all other crops has recorded a sharp decline. All other major crops have experienced the increase in productivity but it was not that much appreciable as experienced by wheat and rice. A higher increase in productivity of these two crops due to higher success of HYV seeds and assured purchase by the State agencies has resulted in very important changes in production structure. Paddy/rice was not considered as a suitable crop for the agro-climatic conditions of Punjab, but the area under rice increased from 5.19% of the net sown area in 1960–61 to 36.20% in 2012–13, whereas the area under other crops, viz. gram declined from 19.18% in 1961–62 to only 0.03% in 2012–13. The situation is also the same in case of all the other crops. This shift in the cropping pattern in favour of wheat and paddy/rice has seriously affected the ecological balance in Punjab, particularly the level of groundwater.

This change in the cropping pattern towards wheat–rice has not only shifted the production pattern of the state's agriculture from diversification to monoculture but it has also resulted in decline in growth rate of production of both these principal crops. From the 1970s onwards, both the crops have recorded a steady decline in

**Table 7.3** Shift in the cropping pattern

| Crops                 | 1960–61         | 1970–71         | 1980–81         | 1990–91         | 2000–01         | 2012–13         |
|-----------------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| Rice                  | 227<br>(5.19)   | 390<br>(8.30)   | 1095<br>(15.75) | 1906<br>(25.41) | 2506<br>(31.56) | 2849<br>(36.20) |
| Maize                 | 327<br>(7.48)   | 555<br>(11.82)  | 127<br>(1.88)   | 160<br>(2.13)   | 154<br>(1.94)   | 124<br>(1.58)   |
| Bajra and Jawhar      | 129<br>(2.95)   | 207<br>(4.40)   | 70.1<br>(1.04)  | 12.03<br>(0.16) | 06<br>(0.08)    | 03<br>(0.04)    |
| Groundnut             | 679<br>(15.54)  | 174<br>(3.70)   | 83<br>(1.23)    | 11<br>(0.15)    | 04<br>(0.05)    | 1.7<br>(0.02)   |
| Cotton                | 447<br>(10.22)  | 397<br>(8.45)   | 649<br>(9.60)   | 701<br>(9.34)   | 474<br>(5.97)   | 481<br>(6.11)   |
| Sugarcane             | 133<br>(3.04)   | 128<br>(2.72)   | 392<br>(5.80)   | 601<br>(8.01)   | 777<br>(9.79)   | 483<br>(6.14)   |
| Sesamum               | 8<br>(0.18)     | 15<br>(0.32)    | 16.9<br>(0.25)  | 18.2<br>(0.24)  | 19.2<br>(0.24)  | 5.3<br>(0.07)   |
| Wheat                 | 1400<br>(32.04) | 2299<br>(48.91) | 2757<br>(40.77) | 3271<br>(43.60) | 3408<br>(42.92) | 3517<br>(44.69) |
| Barley                | 66<br>(1.51)    | 57<br>(1.21)    | 65<br>(0.97)    | 37<br>(0.49)    | 32<br>(0.40)    | 13<br>(0.16)    |
| Gram                  | 838<br>(19.18)  | 358<br>(7.62)   | 258<br>(3.81)   | 60<br>(0.80)    | 08<br>(0.10)    | 2.4<br>(0.03)   |
| Rapeseeds and mustard | 107 (2.46)      | 103<br>(2.19)   | 136<br>(2.01)   | 69<br>(0.92)    | 55<br>(0.69)    | 29<br>(0.37)    |
| Potato                | 9<br>(0.21)     | 17<br>(0.36)    | 39.7<br>(0.59)  | 23.1<br>(0.31)  | 59.6<br>(0.75)  | 64.4<br>(0.82)  |

*Note* The figures in parentheses represent percentages of area under crops

*Source* Statistical Abstract of Punjab, various issues

**Table 7.4** Growth rate of wheat–rice yield (percent/year)

| Years              | Rice | Wheat |
|--------------------|------|-------|
| 1971–72 to 1981–82 | 4.57 | 2.07  |
| 1981–82 to 1991–92 | 1.89 | 2.77  |
| 1991–92 to 2001–02 | 0.40 | 2.18  |
| 2001–02 to 2011–12 | 0.98 | 0.10  |

*Source* Calculated from Statistical Abstract of Punjab, various issues

the growth rate of yield. During the period from 2001–02 to 2011–12, the annual growth rate of rice yield was 0.98%, and that of wheat was 0.10%. On the other hand, the state government under the pressure of neoliberal policies has been continuously reducing the funding for research and development activities. The lack of State initiative has caused the movement of growth of these two principle crops towards stagnation (Table 7.4).

The introduction of the neoliberal policies during the 1990s along with the shift in the cropping pattern in favour of wheat and paddy and decline in their growth

**Table 7.5** Decline in growth rate of agriculture production in Punjab

| Years              | Growth rate |
|--------------------|-------------|
| 1965–66 to 1975–76 | 6.63        |
| 1975–76 to 1985–86 | 4.74        |
| 1985–86 to 1995–96 | 2.40        |
| 1995–96 to 2005–06 | 1.89        |
| 2005–06 to 2014–15 | 1.31        |

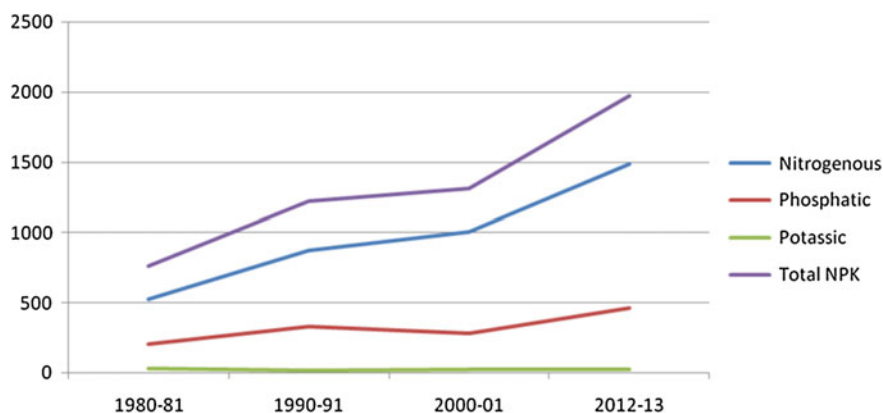
*Source* Calculated from Statistical Abstract of Punjab, various issues

rates of yield have negatively affected the overall growth of agriculture production in Punjab. Table 7.5 highlights that the growth of agriculture production was quite high during the initial years of the Green Revolution, but after that it has recorded a continuous decline.

The growth rate of agriculture production in Punjab was 0.21% during the period of 2013–14, whereas the growth rate of agriculture sector at all-India level was between 3 and 3.5% during the same period. This decline in growth rate on the one hand and the retreat of the state under the pressure of neoliberal reforms from investment and input distribution affairs in agriculture have given birth to an agrarian crisis. The unfavourable shift in cropping pattern, decline in productivity of both the major crops and the stagnation of agricultural growth are presenting the specificity of crisis of neoliberal capital-driven agriculture.

### 7.1.5 *Excessive Use of Chemical Inputs*

The other important change which agrarian production structure has experienced is excessive dependence of market-based purchase of fertilizers and other related inputs for the success of new varieties of seeds. One of the major agenda of imperialist countries after the decolonialisation of some major economies of the world was to provide market for imperialist countries produce. In order to provide the market for industrial products of developed nations, imperialist countries had used the political power to influence the national strategy of Third World countries. As showed above, India was influenced by imperialist countries to adopt high-yielding variety technology so that they can solve the market problem for their agricultural inputs producing industries. In order to provide the market for imported seeds, chemical fertilizers, insecticides, pesticides, etc., the State has provided the necessary subsidies on these inputs. This has resulted in a phenomenal transformation in traditional modern methods of farming and farm management. In comparison to the other states of Indian union, the farmers of Punjab were inclined more towards the HYV seeds and consumption of fertilizers. The announcement of the minimum support price for wheat and rice was one of the important steps taken by the state for enhancement of market-based farm input use. An increase in area under these two crops has resulted in a remarkable increase in industrial produce input use



**Fig. 7.1** Consumption of chemical fertilizers in Punjab (000 nutrients tons). *Source* Singh (2011)

in agriculture. The consumption of total NPK in Punjab increased from 762,000 nutrient tons 1980–81 to 1972 nutrients tons in 2012–13 (Fig. 7.1).

In 1965–66, Punjab was lagging behind a number of states (most notably, Tamil Nadu, Kerala and Andhra Pradesh) in regard to per hectare fertilizers consumption. Since 1965–66, per hectare consumption of fertilizers in Punjab increased quite rapidly, and it has left all the other states far behind. Punjab is now consuming over 8% of the total fertilizer consumption in the country. The situation is also same in case of insecticides and pesticides consumption, which has surged from 3200 metric tons in 1980–81 to 5720 metric tons in 2014–15. The excessive chemicalisation of agriculture production has not only increased the cost of cultivation but it has also seriously affected the health of soil, water, human beings and animals.

### 7.1.6 Market-Driven and Market-Oriented Production

An increased cost of production due to excessive use of market-based input-driven agriculture, farmers were forced to change their production structure according to the market needs. This has resulted in growth of commodity production and capitalist relations. Kautsky (1988) briefly explained the importance of commodity production and market network for the development of capitalism in agriculture. The development of state agriculture on capitalist lines has increased the extent of capitalist commodity production. Now, the peasants of all classes are involved in the network of commodity market relations (voluntarily or involuntarily) for consumption requirement, input purchase and sale of produce. The farmers of different classes have become commodity producers who sell a major part of their output in the market. In the present analysis, market arrival of agricultural production is chosen as an indicator of commoditisation of agrarian production structure, which is an important feature of the capitalist development in agriculture. In the early

**Table 7.6** Marketisation of agricultural production

| Years   | Market arrivals<br>(in 000' Qts) | Average number of villages<br>served per regulated market | Average area served per<br>regulated market (km <sup>2</sup> ) |
|---------|----------------------------------|-----------------------------------------------------------|----------------------------------------------------------------|
| 1971    | 48,176                           | 139                                                       | 573                                                            |
| 1981    | 103,310                          | 112                                                       | 462                                                            |
| 1991    | 203,709                          | 86                                                        | 352                                                            |
| 2001    | 270,559                          | 86                                                        | 350                                                            |
| 2011    | 299,589                          | 85                                                        | 345                                                            |
| 2013–14 | 299,642                          | 81                                                        | 290                                                            |

Source Statistical Abstract of Punjab, various issues

decades of the Green Revolution, special attention was given for the development of Mandi towns in Punjab so that assured market can be provided to the farmers. The development of these towns leads to the growth of market-oriented production (Singh and Tiwana 2015). Table 7.6 highlights that the market arrivals in Punjab have increased continuously over the period of time. The average number of villages served per regulated market decline from 139 in 1971 to 81 in 2013–14, and the average area served by regulated market also recorded a decline from 573 km<sup>2</sup> in 1971 to 290 km<sup>2</sup> in 2013–14. It clearly indicates the market orientation of agrarian production structure, which has further changed the production relations on capitalist lines.

### ***7.1.7 Overcapitalisation of Production Process and Decline in Labour Employment***

Mechanisation is another important feature of capitalisation of production process. The introduction of machinery in production reduces the requirement of labour per unit of production. In other words, the increased capital intensity means decline in the requirement of labour services for the given production process. The decline in employment of human labour in Punjab agriculture is related to the process of overcapitalisation of production process. The development of capitalism in agriculture is positively associated with the increased use of machinery. The introduction of machinery leads to the replacement of labour services. The mass-scale of employment of agricultural machinery presupposes the existence of mass agriculture wage workers. As Lenin (1956) pointed out, 'the localities where agricultural capitalism is most developed this process of introduction of wage labour along with the introduction of machines is intersected by another process, namely, the ousting of wage workers by the machines'.

Table 7.7 provides the information regarding the use of human labour and machine labour for two principle crops (wheat and paddy) and changes therein over a period of time. The data clearly showed that family labour has resulted in a sharp

**Table 7.7** Use of human and machine labour in agriculture for principle crops in Punjab (man-h/ha)

| Particulars                   | Wheat   |         |                     | Paddy   |         |                     |
|-------------------------------|---------|---------|---------------------|---------|---------|---------------------|
|                               | 1985–86 | 2006–07 | Change              | 1985–86 | 2006–07 | Change              |
| <i>Human labour (man-h)</i>   |         |         |                     |         |         |                     |
| Family                        | 218.99  | 69.81   | –149.18<br>(–68.12) | 308.09  | 136.98  | –171.11<br>(–55.54) |
| Permanent                     | 44.83   | 28.17   | –16.66<br>(–37.16)  | 75.70   | 63.71   | –11.99<br>(–15.84)  |
| Casual                        | 164.24  | 85.74   | –78.50<br>(–47.80)  | 434.59  | 209.72  | –224.87<br>(–51.84) |
| Hired<br>(permanent + casual) | 209.07  | 113.91  | –95.16<br>(–45.52)  | 510.29  | 273.43  | –236.86<br>(–46.42) |
| Total labour                  | 428.06  | 183.72  | –244.34<br>(–57.08) | 818.38  | 410.41  | –407.97<br>(–49.85) |
| Bullock labour (h)            | 28.60   | 0.87    | –27.73<br>(–96.96)  | 31.16   | 1.08    | –30.53<br>(–96.58)  |
| <i>Machine Labour (h)</i>     |         |         |                     |         |         |                     |
| Tractor                       | 11.72   | 15.64   | 3.92<br>(33.45)     | 10.14   | 15.94   | 5.80<br>(57.20)     |
| Combine harvester             | 0.09    | 1.16    | 1.07<br>(1188.89)   | 0.33    | 1.50    | 1.17<br>(354.55)    |
| Irrigation machines           | 47.52   | 52.04   | 4.52<br>(9.51)      | 337.47  | 265.97  | 28.50<br>(8.45)     |

*Note* Figures within the parentheses indicates percent change over time

*Source* Comprehensive scheme to study the cost of cultivation of principle crops in Punjab, 1985–86 and 2006–07

decline in man-hours for both wheat and paddy cultivation. The permanent labour has recorded more declines in case of wheat as compared to paddy. The fundamental reason behind the difference is that paddy is a more labour-intensive crop as compared to wheat because it requires continuous irrigation. Casual labour has also experienced decline in case of both the crops. In overall, human labour has experienced a very sharp decline during the period from 1985–86 to 2006–07. On the other hand, the use of machinery has increased in case of both the major crops. The use of tractors in case of wheat has increased by 33.45% from 1985–86 to 2006–07, whereas in case of paddy it has increased by 57.20% during the same period (vide Table 7.7). This transformation has led to a specific type of crisis in rural economy of Punjab. There is a continuous decline in use of labour in production of crops. Various estimates of employment elasticity with respect to aggregate output showed continuous decline from 0.54 during the 1970s to 0.20 in the 1990s and presently it becomes negative. So, if we assume it to be positive at 0.20 then it means 5% rate of growth of agriculture output is required to create 1% increase in employment (Sidhu 2002). But the data on agricultural output growth showed a steady decline. The phenomenal transformation from regular agricultural labour to wage workers



presents the causalisation of labour, and the increased use of machinery has resulted in an increase in reserved pool of agricultural proletariats.

The agrarian sector is experiencing stagnation in production and productivity, which has very serious implications for the income of farming community. The analysis shows the crisis at the macro level, which has resulted in varied forms of crisis at the disaggregate village levels. The change in production structure has resulted in the change of class composition, which is taken up in the subsequent section.

## 7.2 Changes in Production Relations

The capitalist development in agriculture has been relatively faster in Punjab as compared to national level largely due to over emphasis on the new agricultural strategy. In the changing production relations, the most important change that the state has experienced is the decline in dominant feudal class structure and feudal production relations and rise of commodity and market-centred relations. The important changes in production relations can be explained as under.

### 7.2.1 *Cultivable Area Per Agriculture Worker*

It is a well-known fact that in a capitalist economy, the development of the agricultural sector on capitalist lines leads to the rise in the cultivable area per agricultural worker (e.g. USA and U.K.). Due to the development of agriculture on capitalist lines, agricultural land also became a commodity much more often than in the past. There are mainly two causes of this process: first, because of the willingness as well as capacity of the top peasantry to add more land to their ownership. Second, due to the rapid progress of urbanisation, the prices of land have increased disproportionately to its productivity. The introduction of capital equipment, science and better organisation in production process has replaced manpower. Table 7.8 provides information regarding the cultivable area per agriculture worker in Punjab. The data reveals that the cultivable area per agriculture worker has recorded a decline rather than increase from 1.75 in 1971 to 1.25% in 1991. In 2001, there was an increase in cultivable area to 1.44 but it still recorded less than the cultivable is per agriculture worker in previous two decades that is 1971 and 1981. The decline in the cultivable area in Punjab after the introduction of new agricultural strategy primarily occurred because the income growth in the agriculture sector remained higher than the other rural occupations that's why people moved towards the agricultural sector. Either they have purchased some land or join the agricultural sector as labourers.

In the latter decades (1991, 2001 and 2011), the excessive mechanisation of cultivation methods has reduced the requirement of labour for the production process that has resulted in the increase in cultivable area. The other reason is

**Table 7.8** Progress in cultivable area per agricultural worker in Punjab (in hectare)

| Years | Cultivable area per agriculture worker |
|-------|----------------------------------------|
| 1971  | 1.75                                   |
| 1981  | 1.50                                   |
| 1991  | 1.25                                   |
| 2001  | 1.44                                   |
| 2011  | 2.23                                   |

*Source* Calculated from Statistical Abstract of Punjab, various issues

decline in income and profit margin in agriculture that has further been aggravated by the decline in growth of the agriculture sector. The small and marginal cultivators along with agriculture labour have forced by the conditions to leave their occupation.

### 7.3 Changes in Class Composition in Rural Punjab

The development of production forces and changes in production structure can be presented clearly by using the data, but the understanding about the changing relations is not that simple. However, an understanding of changes in relations is central to the understanding of change in class composition and agrarian question in rural Punjab. For this purpose, three points stand important: first, it requires identification of the changing character of various classes in the state after the implementation of new agricultural strategy of market-oriented production. Second, the changing character of family and wage labour due to change in the production structure on capitalist lines. Third, the method of surplus extraction under changed production structure.

The historical understanding of the village economy shows that prior to the introduction of the Green Revolution technology there was a dominance of big landowners. They were not cultivating land of their own. Most of the cultivation activities were done by the tenants. After the introduction of the Green Revolution strategy and integration of the village agriculture with the market, along with this class, there was emergence of a new class of capitalist farmers. This new class was not the same class that was historically big land owning class. This newly emerged class prior to the Green Revolution was cultivating the land through their family labour. But after the introduction of new agricultural strategy, this class has adopted the modern methods of cultivation. The machinery and capital equipment along with wage labourers become the major means of production. This can be observed from the fact that the number of paid wage labourers has increased after the Green Revolution. The increased demand for agriculture labour was filled by the migration of agricultural labourers from other states. According to an estimate, the number of migrant agricultural labourers in Punjab was 1.35 lakh during 1974–75 and this number increased to 8.42 lakh in the peak season during 2006–07. The percentage

of migrant labourers to the total male agricultural labourers has increased from 16.77% in 1974–75 to 74.58% in the peak season during 2006–07 (Sharma 2011). During the early years of the Green Revolution, accumulation and reinvestment of surplus value was the major initiative that provides this class the significant dominance in the rural economy along with the historical big landowning class.

These two classes, big landowners and capitalist farmers, are the economically, politically and socially dominant classes in the village economy. The big landlord class has maintained their position largely due to the ownership of large amount of land that is shifted to them by their feudal forefathers. The latter class emerged as a powerful class which has utilised the Green Revolution strategy through investment in modern methods of cultivation. In other words, the basis of the power of these two classes was their control over the land. The accumulation process in village economy after the introduction of new agricultural technology was largely caused by the modern methods of cultivation on the capitalist lines. At present, these two classes are the part of rural hierarchy and playing a leading role in emerged socio-economic system.

Although, these two classes constitute a very small proportion of total population in rural economy they jointly own huge amount of land and capital resources at the village level. They are not only economically powerful but also enjoy sufficient political power to supplement their economic dominance. The data in Tables 7.9 and 7.10 shows that during 1971, out of the total operational holdings, 56.54% were marginal and small and cultivating only 15.03% of the total area. After 1971, the marginal and small farms have experienced a continuous decline and it was recorded 34.19% in 2011 and the area under marginal and small holdings was declined to 9.33% of the total operational area in 2010–11. In case of medium farms (2–4 ha), the operational holdings increased from 20.44 to 30.83% from 1971 to 2011. But the area under these holdings increased marginally from 20.01 in 1971 to 21.56%.

The data also shows that in 2011, the small and marginal farms (less than 2 ha) constituted 34.98% of the operational holdings, which cultivated only 9.33% of the total operational area in Punjab. The large and extra-large farms (above 4 ha) together constitute 26.98% of the total operational holdings and cultivate 69.11% of the total operation area in Punjab. The large and extra-large farms are owned by the

**Table 7.9** Distribution of operational holdings by size group in Punjab (in percentage)

| Years | Marginal and small farms (below 2 ha) | Medium farms (between 2 and 4 ha) | Large farms (between 4 and 10 ha) | Extra-large farms (above 10 ha) |
|-------|---------------------------------------|-----------------------------------|-----------------------------------|---------------------------------|
| 1971  | 56.54                                 | 20.44                             | 18.01                             | 5.01                            |
| 1981  | 38.62                                 | 27.98                             | 25.61                             | 7.25                            |
| 1991  | 44.72                                 | 25.86                             | 23.41                             | 6.01                            |
| 2001  | 29.66                                 | 32.91                             | 30.18                             | 7.25                            |
| 2011  | 34.19                                 | 30.83                             | 28.36                             | 6.62                            |

Source Statistical Abstract of Punjab, various issues

**Table 7.10** Distribution of operational area among size groups

| Years   | Marginal and small farms | Medium farms          | Large farms            | Extra-large farms      | Total                 |
|---------|--------------------------|-----------------------|------------------------|------------------------|-----------------------|
| 1970–71 | 600,385<br>(15.03)       | 7,951,07.9<br>(20.01) | 1,514,223.3<br>(38.10) | 1,067,373.1<br>(26.86) | 3,974,091.1<br>(100)  |
| 1980–81 | 399,130<br>(9.52)        | 790,855<br>(18.87)    | 1,565,674<br>(37.36)   | 1,434,717<br>(34.24)   | 4,190,376<br>(100)    |
| 1990–91 | 492,000<br>(12.20)       | 841,000<br>(20.86)    | 1,622,000<br>(40.23)   | 1,077,000<br>(26.71)   | 4,032,000<br>(100.00) |
| 2000–01 | 319,514<br>(7.94)        | 876,441<br>(21.85)    | 1,730,713<br>(43.17)   | 1,095,590<br>(27.03)   | 4,022,258<br>(100)    |
| 2010–11 | 370,088<br>(9.33)        | 855,112<br>(21.56)    | 1,712,859<br>(43.18)   | 1,028,575<br>(25.93)   | 3,966,634<br>(100)    |

*Note* Figures in parentheses represent percentages of operational area

*Source* Agriculture census, Government of India

big landlords and capitalist farmers which apply all the modern methods of cultivation and majority of the operation on filed is done by the agriculture labour (both permanent and casual).

Up to the 1990s, the major process of accumulation by these two classes is actualised through agricultural production process. However, after the introduction of neoliberal reforms and deterioration of terms of trade for agriculture has changed the methods of surplus extraction in rural Punjab. Beside agriculture as a source of surplus extraction, they also controlled the other means from where they extract the surplus. Many landlords and big capitalist farmers are also involved in lucrative business activities such as money lending, grain mills, lodging houses, sale and lease of agricultural machinery, rice mills, big dairy farming activities, transport, education institutions, buildings on rent, petrol pumps, marriage palaces, receiving income from financial assets. Along with this, they also have good network with the administrative or local political superstructure such as bureaucracy, local panchayat members, members of legislative assembly. These two classes of rural economy have good connections with the political parties and local voters. All the political parties want to continue the good relationship with this class in order to maintain their vote bank in rural areas because the political rights of the weaker sections in rural areas are largely used by or influenced by these classes.

These classes are exploiting the other classes in rural areas by using many methods such as exploitation of labour power of the wage workers, extraction of surplus through high rent from tenants, high rate of interest though money-lending activities to the weaker sections in rural areas, forced purchase of land resources from the small cultivators. Even the State-sponsored schemes and subsidies are mostly utilised by these two classes. For example, the electricity subsidy to agriculture is mostly utilised by these big farmers because a very small section of small peasantry does have electrical tube wells in Punjab. Even the other type of schemes such as subsidised food and employment programmes are utilised by these farmers due to their economic and political dominance in rural areas. In this sense, the

**Table 7.11** Percentage of cultivators and agricultural labourers in Punjab

| Years | Cultivators | Agricultural labourers | Agricultural labourer as percentage of cultivators |
|-------|-------------|------------------------|----------------------------------------------------|
| 1971  | 42.66       | 20.11                  | 47.24                                              |
| 1981  | 35.86       | 22.16                  | 61.80                                              |
| 1991  | 31.44       | 23.82                  | 75.78                                              |
| 2001  | 26.62       | 16.32                  | 72.14                                              |
| 2011  | 19.55       | 16.05                  | 82.11                                              |

Source Statistical Abstract of Punjab, various issues

landowning class and big capitalist farmers are not the only economic category in Punjab's country side; rather it is also a political and social category that is dominating the agrarian mode of production.

The other important class in rural economy is agriculture labourers. Tse-tung (1967) has defined agriculture labour: 'the farm labourers as a rule own no land or farm implements, though some of them own a very small amount of land and very few farm implements'. These workers make their living wholly or mainly by selling their labour power. The proportion of agricultural labourers as percentage of total workers has increased in Punjab from 20.11% in 1971 to 23.82 in 1991. In 2011, the proportion of agricultural labourers has recorded a decline in their percentage to 16.05% (Table 7.11).

It has primarily occurred due to the decline in the proportion of cultivators on the one hand and stagnation of real wage rate in the agriculture sector in comparison to the other sectors, on the other. The excessive mechanisation has resulted in the decline of requirement of agriculture labour for the production purpose. They are not only working as agricultural labourers but also become *labourers in general* due to the excessive mechanisation of agricultural activities in the countryside. Due to the intensification of new agricultural strategy and overcapitalisation of production, the permanent agricultural labour is on the decline in rural Punjab. They are hired by big farmers on a monthly basis during the peak season and on casual basis for daily activities. A good proportion of labour class which was earlier working as permanent agriculture labourers in rural economy moved to other informal activities such as construction, brick industry, waiters in marriage palaces in nearby towns/cities.

### 7.3.1 Agriculture Labour as Percentage of Cultivators

Agricultural labourers as percentage of cultivators are an important indicator of proletarianisation of the peasantry. During the initial process of capitalistic development in agriculture, the small and marginal farmers who lost their land due to unfavourable production conditions in the agricultural sector generally remained in

agricultural occupation and joined the same occupation as labourers. Later on, with the introduction of labour-saving technology (machinery and related equipment) these workers were replaced from agricultural occupation and they generally moved towards the urban areas for the search of livelihood. Kautsky explains the capitalist nature of agriculture and also explains the influence of agricultural machines upon the workers. He argued that agricultural machines will continue their transforming activity: they will drive the rural workers in the towns on the one hand and for the further development of the employment of machinery in agriculture, on the other (Lenin 1960).

The proportion of agriculture labour as a percentage of cultivators has recorded a very sharp increase from 47.24 in 1971 to 75.78% in 1991. The introduction of labour-saving technology has not made much negative effect on agricultural labour during this period. But after the introduction of neoliberal policies in 1991, there was decline in proportion of agricultural labour as a percentage of cultivators in Punjab, and it has recorded 72.14% in 2001. However, the recent census data shows that this proportion has increased to 82.11%. The other important change which this class has experienced due to the commercialisation of production is the change in the mode of payment. Earlier the permanent labourers were getting a major proportion of their wages in real terms that is in kind. But now the major proportion of wages is paid by big farmers in monetary terms. This has very serious implication for the livelihood of the labour class in rural economy because the prices of food grains are increasing at higher rate than the increase in wage rate in rural areas. This has resulted in decline in real wages in rural areas and decline in purchasing power of the weaker sections.

## 7.4 Concluding Remarks

This study has attempted to examine the changes in production structure and class composition in agriculture within the theoretical context of agrarian question propounded under the Marxian analysis. Taking Punjab as a case study, the analysis highlights that the agricultural sector in the state has experienced important changes in the production structure through favourable policies and investments in irrigation and other infrastructure, primarily to make the Green Revolution strategy successful. No doubt, these changes, which were superimposed by the national strategy of self-sufficiency in food, have resulted in an increase in production and productivity for more than two decades. At the same time, it has led to a crisis in the state as the monoculture (wheat–paddy rotation) has replaced the traditional crops; HYV seeds have replaced the traditional seeds; mechanisation has replaced the labour-intensive traditional agricultural practices; chemicalisation has replaced the usage of organic manure and family farming has been replaced by market-oriented production. These changes in the production structure have not only adversely affected the production structure but have also resulted in high cost in terms of environment degradation.

The farm income and productivity has already moved towards stagnation across the state. The capital-driven agriculture has uprooted the cultivators who were not able to afford the higher cost of modern inputs. The production relations have got altered as per changes in the production structure. The rural economy in the state is dominated by big landlord class who is involved in cultivation practices as well as in subsidiary activities. The problem has aggravated since 1991 following the neoliberal reforms whereby new laws, rules and other policy decisions have strengthened the power of the big landowning class and the new Green Revolution-generated rich capitalist farmer class (both these have the same class interests so act as a unified group) and has enabled their capacity to diversify occupation to maintain/increase profits. The capital earned by big landlords due to the implementation of capitalist methods of cultivation has been reinvested not only in agriculture but also in other occupations. A diversification in investment has played a key role in maintaining their economic, social and political dominance in rural hierarchy. It is important to note that despite changes in the production structure and production relations in the state, land ownership along with capital plays a central role in the determination of production relations. In this sense, the agrarian question is still significant in rural Punjab to understand the changes in the mode of production and class composition. In this context, the farmers and agricultural labour organisations may require a concrete understanding and an analysis of the situation to fight for their interests and rights.

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# Chapter 8

## Disparities in Agriculture Income Across the Indian States

Prabhjot Kaur and Sharanjit Singh Dhillon

### 8.1 Introduction

In India, a high percentage of population lives in the rural areas and is engaged mainly in agriculture activities for livelihood. Though the share of agricultural income in total gross domestic product (GDP) has been declining, the performance of the economy and the standard of living of a large section of population depend considerably on growth in the agricultural sector. With a view to accelerate agricultural growth, both central and the state governments have initiated several measures, major being land reforms and large investments in irrigation, roads and other rural infrastructure. In spite of the continuous efforts of policymakers, agricultural growth has been concentrated in a few select Indian states in the north and south. The states falling in the central and eastern regions have lagged behind though some evidence of an improvement in their rate of agricultural growth is reported in the recent years. The introduction of the high-yielding variety (HYV) technology in the mid-1960s was instrumental in bringing about unprecedented growth in the output and yield of wheat and rice in Punjab, Haryana and Western Uttar Pradesh. These states backed by public policies and investments in irrigation were able to realize significant acceleration in crop output over the period and got the tag of food basket in the country. However, it might have been one of the factors behind growing disparities in the level and growth of agricultural output across the states (Ghosh 2013).

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A large body of the literature has investigated into a growing trend in regional disparities in economic development in India and causes thereof. Among many, Ghosh et al. (1998), Rao et al. (1999), Dasgupta et al. (2000), Trivedi (2002), Bhattacharya and Sakthivel (2004), Nayyar (2008), Kalra and Sodsriwiboon (2010) and Cherodian and Thirlwall (2013) pointed towards increasing regional inequalities in income. Contrary to this result, Cahin and Sahay (1996) and Raju (2012) found convergence in per capita income across the states. It is argued that regional disparities in per capita income have been largely due to sizeable variations in agricultural development. In other words, disparities in agriculture are considered as one of the major sources of persisting regional inequalities in per capita income. A need is, therefore, felt to examine the disparities in agricultural income across the states, for which convergence hypothesis has been examined. The subject also holds importance as there has been a consensus that growth in agriculture is associated with reduction in poverty. Cross-country comparisons on income and poverty levels and agricultural development have also consistently found that higher levels of agricultural development are associated with lower levels of poverty and inequality in the rural areas.

The chapter is organized into five sections. Following introduction, Sect. 8.2 explains database and methodology that are used to estimate regional disparities in farm income. Section 8.3 empirically estimates  $\sigma$ -convergence, unconditional  $\beta$ -convergence and conditional  $\beta$ -convergence based on net state domestic product (NSDPA) originating from agricultural sector over the period 1980–2011 across 24 Indian states. They are Andhra Pradesh (AP), Assam (AS), Bihar (BH), Gujarat (GJ), Haryana (HR), Himachal Pradesh (HP), Jammu and Kashmir (JK), Karnataka (KT), Kerala (KR), Madhya Pradesh (MP), Maharashtra (MH), Manipur (MN), Orissa (OR), Punjab (PB), Rajasthan (RJ), Tamil Nadu (TN), Tripura (TR), Uttar Pradesh (UP), West Bengal (WB), Arunachal Pradesh (AR), Goa (GOA), Meghalaya (MG), Nagaland (NG) and Sikkim (SKM). This is followed by time series unit root stochastic convergence of NSDPA in Sect. 8.4. The last section draws conclusions.

## 8.2 Data Source and Methodology

The study is based on secondary data compiled at constant (real) prices for 24 Indian states over the period 1980–81 to 2011–12. The time series on NSDPA were available at four base years, viz. 1980–81, 1993–94, 1999–2000 and 2004–05. The series were converted into a common base year at 2004–05 in states using the splicing method. Data is compiled from various sources, viz. CSO (Central Statistical Organisation), Statistical Abstract of Punjab, Centre for Monitoring Indian Economy (CMIE) and Economic and Political Weekly Research Foundation 2011. The following analytical techniques have been applied.

### 8.2.1 $\sigma$ -Convergence

$\sigma$ -convergence occurs if the standard deviation of the natural log ( $\ln$ )  $y_{i,t}$  tends to decrease over time, that is if  $\sigma_{t+T} < \sigma_t$  where  $\sigma_t$  is the standard deviation of natural log ( $\ln$ )  $y_{i,t}$  across  $i$  states;  $t$  is initial year of the respective individual state and  $T$  is the length of the period considered;  $y$  represents the variable selected for examining convergence. In this study,  $\sigma$ -convergence has been examined by measuring the standard deviations across states of the natural log ( $\ln$ ) of the respective variable under consideration. If the standard deviation across states tends to decline over time, then there will be sigma convergence otherwise it is taken to be sigma divergence.

### 8.2.2 Unconditional $\beta$ -Convergence

The second measure called “ $\beta$ -convergence” refers to “an inverse relation between the relative growth rate of per capita variable under consideration and its value at initial level-occurs when poor states tend to grow faster than the rich ones, in opposite case the situation will be of  $\beta$ -divergence” (Barro 1991). For testing unconditional  $\beta$ -convergence hypothesis, we use the following equation:

$$\Delta y_{i,t,t+T} = \alpha - [\ln(Y_{i,t})] (1 - e^{-\beta T}) (1/T) + \varepsilon_{i,t} \quad (8.1)$$

where

$$\Delta y_{i,t,t+T} = \frac{\ln\left(\frac{y_{i,t+T}}{y_{i,t}}\right)}{T}.$$

$y_{i,t}$  and  $y_{i,t+T}$  are the initial and the last year, respectively, of the individual state  
 “ $\ln$ ” represents natural log  
 “ $i$ ” stands for different states  
 $T$  is the length of time period considered  
 $Y$  represents the variable selected for examining convergence  
 $B$  represents the speed of convergence  
 $\varepsilon_{i,t}$  is the error term

For solving Eq. (8.1), the coefficient  $(1 - e^{-\beta T}) 1/T$  is changed by  $b$  and Eq. (8.1) becomes:

$$\Delta y_{i,t,t+T} = \alpha + b \ln Y_{i,t} + \varepsilon_{i,t} \quad (8.2)$$

$$\begin{aligned}
b &= -(1 - e^{-\beta T}) 1/T \\
-bT &= (1 - e^{-\beta T}) \\
-bT - 1 &= -e^{-\beta T} \\
bT + 1 &= e^{-\beta T} \\
\ln(bT + 1) &= -\beta T \\
-\beta T &= \ln(bT + 1) \\
-\beta &= 1/T \ln(bT + 1) \\
\beta &= -1/T \ln(bT + 1).
\end{aligned} \tag{8.3}$$

Equation (8.3) determines the speed of convergence, and if Eq. (8.2) has a negative slope, then there will be unconditional  $\beta$ -convergence. Equation (8.2) has been estimated by applying ordinary least squares in which the average growth rate of NSDP originating from the agricultural sector is regressed on the natural logarithm of its initial value.

A formal approach to detect the convergence or divergence over time has also been used by plotting annualized growth rates (vertical axis) of NSDPA against natural log (ln) of its initial levels (horizontal axis). The growth rate has been calculated using:

$$\frac{\log\left(\frac{y_{i,t+T}}{y_{i,t}}\right)}{T},$$

where “ $t$ ” and “ $t + T$ ” are the initial year and the last year, respectively, of the individual state  $i$  and  $T$  is the length of the period considered and  $y$  represents the variable under consideration.

### 8.2.3 Conditional $\beta$ -Convergence

According to Sala-i-Martin (1996), “to test the hypothesis of conditional convergence one has to, somehow, hold constant the steady state of each economy”. We have also tried to do it by using variable that is proxy for the steady state in a regression like (Eq. 8.2).

$$\Delta y_{i,t,t+T} = \alpha + b \ln Y_{i,t} + \psi X_{i,t} + \varepsilon_{i,t}, \tag{8.4}$$

where  $X_{i,t}$  is a vector of variables that hold constant the steady state of economy  $i$ , and  $b = (1 - e^{-\beta T}) 1/T$ . If Eq. (8.4) has a negative slope once  $X_{i,t}$  is held constant, then there will be conditional  $\beta$ -convergence.

### 8.2.4 Time Series Unit Root Tests

We have used the standard “Augmented Dickey Fuller (ADF) of unit root test”. For each state  $i$ , we examine the natural logarithm of the ratio of NSDPA relative to the average of all the states.

$$Y_{it} = \ln(\text{NSDPA}_{it} / \text{average NSDPA}_t). \quad (8.5)$$

The ADF test for a unit root developed by “Dickey and Fuller (1979)” has been used to check whether a data is stationary or not. For this, the following type of Augmented Dickey Fuller (ADF) regression has been applied:

$$\Delta Y_t = \mu + \beta t + \alpha Y_{t-1} + \sum_{i=1}^K \delta_i \Delta Y_{t-i} + e_t, \quad (8.6)$$

where  $e_t$  is white noise. The equation is with intercept and time trend.

The hypothesis is:

$$H_0: \alpha = 0$$

$$H_1: \alpha \neq 0.$$

If the calculated ADF statistics are insignificant, then the null hypothesis ( $H_0$ ) is accepted and the series are taken as non-stationary, i.e. the unit root problem exists. Alternatively, if the calculated ADF statistics are significant, then the alternate hypothesis ( $H_1$ ) is accepted and the series is taken as stationary. It provides indications of convergence and divergence.

## 8.3 Empirical Results

### 8.3.1 $\sigma$ -Convergence

$\sigma$ -convergence has been examined by computing the standard deviations of the natural logarithm of NSDPA across 24 states for each year at constant prices (2004–05 prices) from 1980 to 2011. The results of  $\sigma$ -convergence/divergence for NSDPA are shown in Table 8.1, and the same has been depicted graphically in Fig. 8.1.

Table 8.1 shows that the interstate disparities in NSDPA have consistently increased over time. The standard deviation of income originating from agricultural sector increased from 0.326 during 1980 to 0.356 in 1990 to 0.392 in 2000 and further to 0.502 during 2011. Figure 8.1 displays an upward trend in it, indicating

**Table 8.1** Standard deviation ( $\sigma$ -convergence) for NSDPA

| Period | Standard deviation |
|--------|--------------------|
| 1980   | 0.3263             |
| 1981   | 0.3158             |
| 1982   | 0.3485             |
| 1983   | 0.3313             |
| 1984   | 0.3197             |
| 1985   | 0.3480             |
| 1986   | 0.3667             |
| 1987   | 0.3549             |
| 1988   | 0.3587             |
| 1989   | 0.3304             |
| 1990   | 0.3569             |
| 1991   | 0.3586             |
| 1992   | 0.3457             |
| 1993   | 0.3446             |
| 1994   | 0.3475             |
| 1995   | 0.3667             |
| 1996   | 0.3722             |
| 1997   | 0.3616             |
| 1998   | 0.3861             |
| 1999   | 0.3796             |
| 2000   | 0.3923             |
| 2001   | 0.3924             |
| 2002   | 0.3965             |
| 2003   | 0.4028             |
| 2004   | 0.4236             |
| 2005   | 0.3894             |
| 2006   | 0.4385             |
| 2007   | 0.4285             |
| 2008   | 0.4620             |
| 2009   | 0.4874             |
| 2010   | 0.5137             |
| 2011   | 0.5018             |

that the states have diverged in terms of agriculture income. There are clear indications of widening of interstate disparities in NSDPA.

### 8.3.2 *Unconditional $\beta$ -Convergence*

“Unconditional  $\beta$ -convergence—a cross-sectional regression of time-averaged growth rates on initial levels of per capita income giving inverse relationship—

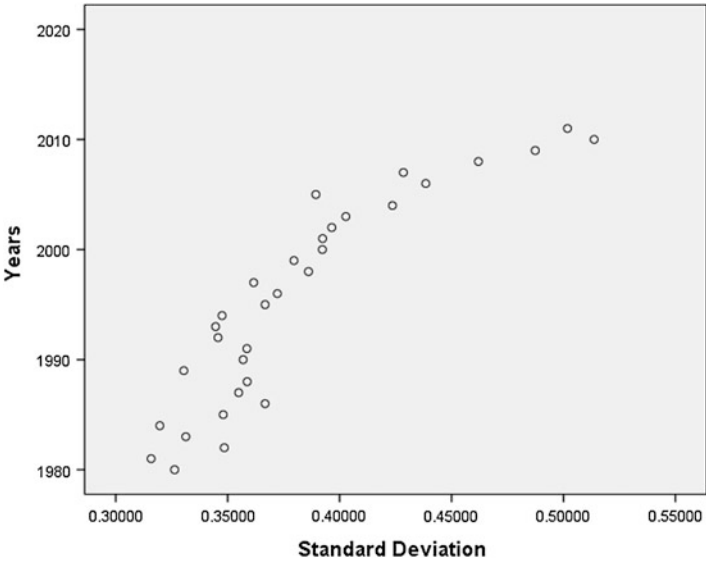


Fig. 8.1 Standard deviation of the ln of NSDPA

Table 8.2 Unconditional  $\beta$ -convergence for NSDPA

| Years     | Constant       | Coefficient      | $\beta$ -convergence | $R^2$ | $N$ |
|-----------|----------------|------------------|----------------------|-------|-----|
| 1980–2011 | −0.2175 (0.00) | 0.0522* (0.00)   | −0.0310              | 0.577 | 24  |
| 1980–1985 | −0.0351 (0.41) | 0.0056 (0.64)    | −0.0055              | 0.009 | 24  |
| 1985–1990 | −0.0246 (0.46) | 0.0013 (0.98)    | −0.0013              | 0.009 | 24  |
| 1990–1995 | −0.0237 (0.50) | −0.0052 (0.96)   | 0.0053               | 0.001 | 24  |
| 1995–2000 | −0.0011 (0.98) | −0.0104 (0.63)   | 0.0107               | 0.010 | 24  |
| 2000–2005 | 0.0187 (0.69)  | −0.0147 (0.342)  | 0.0153               | 0.041 | 24  |
| 2005–2011 | −0.139 (0.00)  | 0.0329** (0.063) | −0.0300              | 0.148 | 24  |

Note Figures in parentheses are  $p$  values; \* and \*\* denote significance at 1 and 10% levels respectively

suggests that poor states (regions) tend to grow faster than the richer states (regions)” (Barro 1991). Unconditional  $\beta$ -convergence (or divergence) has been examined for the whole period (1980–2011) as well as for the sub-periods. In each case, annual average growth rate of NSDPA has been regressed on the natural log of initial level of NSDPA. The results of the estimated cross-sectional convergence regression have been reported in Table 8.2.

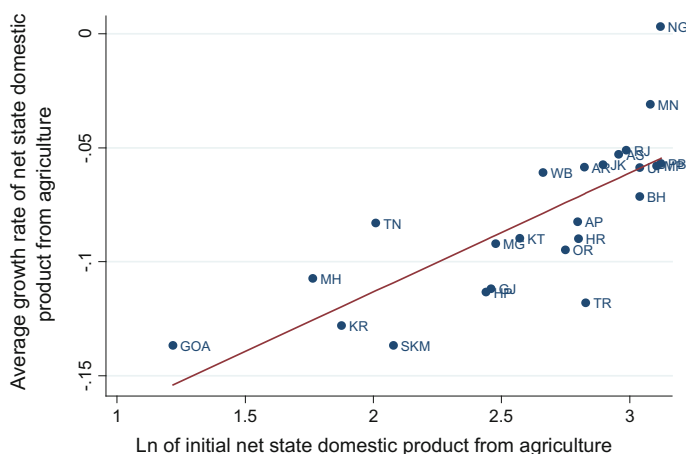
Table 8.2 shows that when the average growth rate for the period 1980–2011 and 2005–2011 has been regressed on the natural log of initial (1980 and 2005) values, respectively, the coefficients turn out to be positive and significant highlighting that divergence is taking place at the rate of 3% per year across states in

NSDPA in both periods. Further, it is noticeable that speed of divergence remains same for the whole period as well as for the latest period and is the maximum during both these periods. The negative but insignificant coefficients for 1990–1995, 1995–2000 and 2000–2005 reveal that the poorer states are catching up with the richer ones during these periods but at a modest rate. The speed of convergence increased from 0.53% per year during 1990–1995 to 1.07 during 1995–2000 and further to 1.53% per year for the period 2000–2005.

Figures 8.2, 8.3, 8.4, 8.5, 8.6, 8.7, 8.8 show the scatter across the 24 states for NSDPA for the whole period as well as for the sub-periods taken in the study. Figures 8.2, 8.3, 8.4 and 8.8 show that the relation between the average growth rate of NSDPA and the natural log of its initial level is positive, confirming the process of cross-state divergence in income. However, in Figs. 8.5, 8.6 and 8.7, the relation turns out to be negative. This strengthens our conclusion that poorer states are catching up with richer ones and revealing  $\beta$ -convergence in income for the periods 1990–1995, 1995–2000 and 2000–2005 across the Indian states.

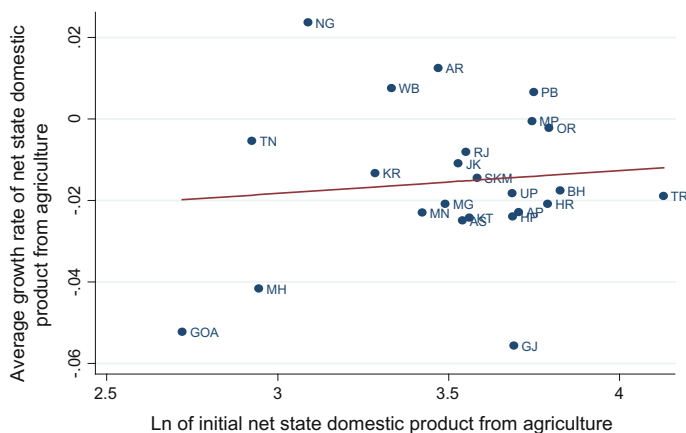
### 8.3.3 Conditional Convergence

The interstate variations in agriculture could be due to differences in agro-climatic conditions, initial physical conditions and agricultural infrastructure. These variations generate different steady states for different regions. If the steady states differ, we have to modify the analysis to consider a concept of conditional convergence. To test the hypothesis of conditional convergence according to Sala-i-Martin (1996), one has to hold constant the steady state of each economy. We have also

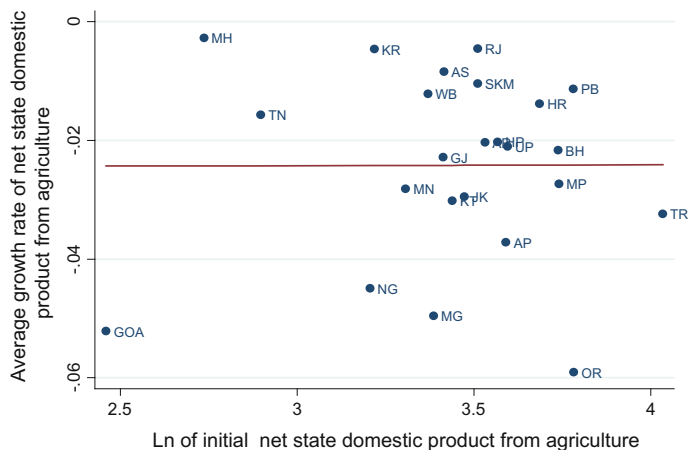


**Fig. 8.2** Average growth rate of NSDPA (1980–2011) against the ln of initial NSDPA (1980)





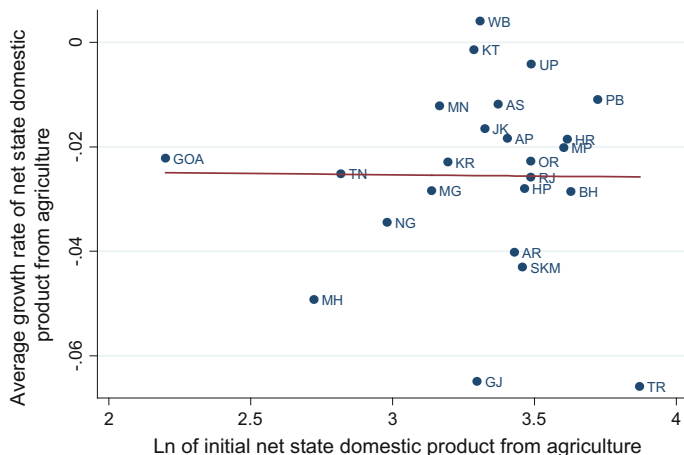
**Fig. 8.3** Average growth rate of NSDPA (1980–1985) against the ln of initial NSDPA (1980)



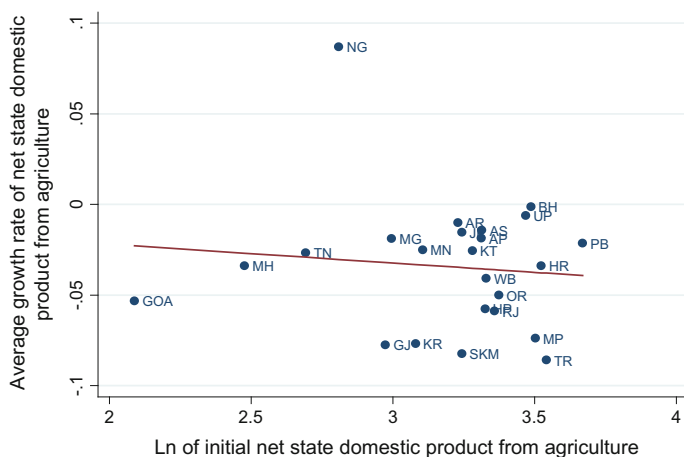
**Fig. 8.4** Average growth rate of NSDPA (1985–1990) against the ln of initial NSDPA (1985)

tried to hold the steady state constant by introducing a proxy variable for the steady state in a regression equation.

The panel data framework for calculating conditional convergence has been obtained following Islam (1995), by moving a single cross-sectional spanning period (1980–2011) to cross sections for the several periods. We have divided the total time period 1980–2011 into five-year shorter time period to apply the panel data formulation. The constructed five-year period is 1980–1985, 1985–1990, 1990–1995, 1995–2000, 2000–2005 and 2005–2011. Average annual growth rate of NSDPA of each five-year span has been regressed on the natural log of NSDPA at the beginning of each period along with other explanatory variables.



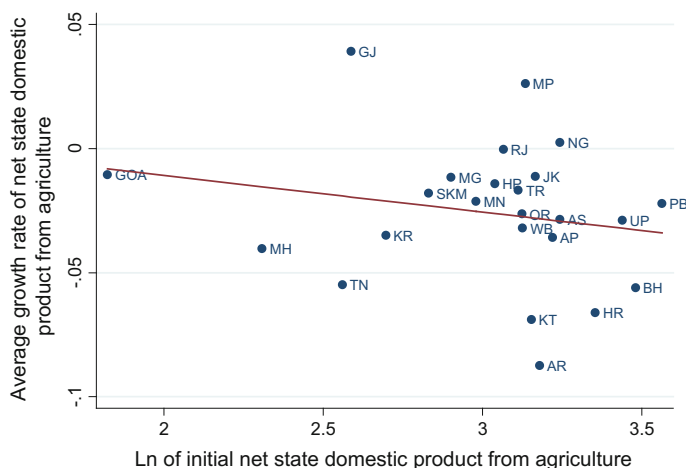
**Fig. 8.5** Average growth rate of NSDPA (1990-1995) against the ln of initial NSDPA (1990)



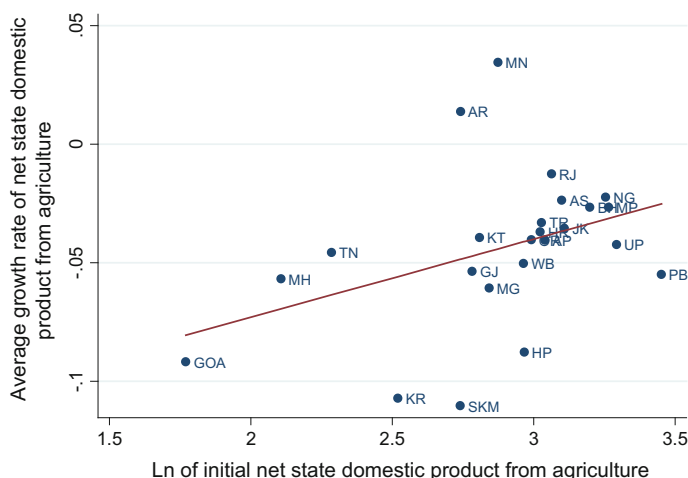
**Fig. 8.6** Average growth rate of NSDPA (1995-2000) against the ln of initial NSDPA (1995)

The following variables have been taken in order to examine the conditional  $\beta$ -convergence:

- (i) Net irrigated area as a % of net area sown ( $X_1$ );
- (ii) % of villages electrified ( $X_2$ );
- (iii) Road density per thousand sq. km of area ( $X_3$ );
- (iv) Consumption of chemical fertiliser per hectare ( $X_4$ );
- (v) Number of tractors per thousand hectares ( $X_5$ ).



**Fig. 8.7** Average growth rate of NSDPA (2000–2005) against the ln of initial NSDPA (2000)



**Fig. 8.8** Average growth rate of NSDPA (2005–2011) against the ln of initial NSDPA (2005)

The results of conditional convergence for NSDPA have been presented in Table 8.3. The estimates reveal that the initial level of NSDPA has a negative and statistically significant coefficient (an evidence of conditional  $\beta$ -convergence), suggesting that poorer states grew faster than richer states, that proxy for differences in steady states is held constant. It has been found that farm income across the Indian states has been converging conditionally at the speed of 2.27% per year. The selected conditioning variables explain 42% variations in NSDPA. Further as expected, the coefficient of net irrigated area has a positive and significant effect on

**Table 8.3** Conditional convergence for NSDPA

|                                                        |                        |
|--------------------------------------------------------|------------------------|
| Constant                                               | 0.5876 (0.00)          |
| <b>Coefficient</b>                                     | −0.0163** (0.01)       |
| $X_1$ (net irrigated area as a % of net area sown)     | 0.0132** (0.02)        |
| $X_2$ (% of villages electrified)                      | 0.0259*** (0.07)       |
| $X_3$ (Road density per thousand sq. km of area)       | 0.0103** (0.03)        |
| $X_4$ (Consumption of chemical fertilizer per hectare) | −0.0725 (0.82)         |
| $X_5$ (Number of tractors per thousand hectares)       | 0.0041* (0.00)         |
| $R^2$                                                  | 0.421                  |
| $F$ -statistics                                        | 2.48* ( $P = 0.000$ )  |
| $\beta$ -convergence                                   | 0.0227                 |
| Hausman specification test                             | 56.43* ( $P = 0.000$ ) |
| $N$                                                    | 144                    |

*Note* Figures in parentheses are  $p$  values; \*, \*\* and \*\*\* denotes significance at 1, 5, 10% levels, respectively

NSDPA. Further, if we look at the physical infrastructure which has been considered as one of the important determinants of output growth, estimates reveal both villages electrified and roads variable turn out to be positive and statistically significant. Increase in road density provides more market access opportunities to people to get connected to core economic activities and thus enhance agricultural growth. The coefficient of fertilizer turns out to be negative but statistically insignificant, revealing that the use of more fertilizers may have a negative effect on agricultural output. Number of tractors per thousand hectares, used as a proxy variable to examine the role of mechanization in agriculture, turns out to be positive and highly significant. These results suggest that interstate variations in agriculture income could be largely due to the variations in the levels of the conditioning variables.

### 8.3.4 Time Series Unit Root Test for Stochastic Convergence

Most time series tests of convergence are related to the notion of “stochastic convergence”. It implies that shocks to income of a given country relative to the average income across a group of countries will be temporary. Thus, a common test for stochastic convergence involves testing for a unit root in the log of the ratio of per capita income relative to the group average. Failure to reject the unit root null hypothesis is an evidence of divergence, whereas rejection of the unit root null supports stochastic convergence (Dawson and Strazicich 2010).

Table 8.4 presents the results of Augmented Dickey Fuller test statistics for NSDPA. Column 2 of each table gives the value of Augmented Dickey Fuller test

**Table 8.4** Stochastic convergence for NSDPA

| 1                 | 2              | 3                            | 4                            | 5                             | 6                                       |
|-------------------|----------------|------------------------------|------------------------------|-------------------------------|-----------------------------------------|
| States            | Test statistic | $\tau$ -critical value at 1% | $\tau$ -critical value at 5% | $\tau$ -critical value at 10% | Acceptance/rejection of null hypothesis |
| Andhra Pradesh    | -2.974 (0)     | -4.284                       | -3.563                       | -3.215                        | Cannot reject $H_0$                     |
| Arunachal Pradesh | -2.902 (4)     | -4.339                       | -3.587                       | -3.230                        | Cannot reject $H_0$                     |
| Assam             | -3.609** (3)   | -4.324                       | -3.581                       | -3.225                        | Reject $H_0$                            |
| Bihar             | -3.533*** (2)  | -4.309                       | -3.574                       | -3.222                        | Reject $H_0$                            |
| Goa               | -1.918 (6)     | -4.374                       | -3.603                       | -3.238                        | Cannot reject $H_0$                     |
| Gujarat           | -4.778* (0)    | -4.284                       | -3.563                       | -3.215                        | Reject $H_0$                            |
| Haryana           | -1.077 (1)     | -4.297                       | -3.568                       | -3.218                        | Cannot reject $H_0$                     |
| Himachal Pradesh  | -3.301*** (0)  | -4.284                       | -3.563                       | -3.215                        | Reject $H_0$                            |
| Jammu and Kashmir | -2.225 (1)     | -4.297                       | -3.568                       | -3.218                        | Cannot reject $H_0$                     |
| Karnataka         | -2.850 (0)     | -4.284                       | -3.563                       | -3.215                        | Cannot reject $H_0$                     |
| Kerala            | -0.066 (2)     | -4.309                       | -3.574                       | -3.222                        | Cannot reject $H_0$                     |
| Madhya Pradesh    | -2.273 (6)     | -4.374                       | -3.603                       | -3.238                        | Cannot reject $H_0$                     |
| Maharashtra       | -3.866** (5)   | -4.324                       | -3.581                       | -3.225                        | Reject $H_0$                            |
| Manipur           | -0.899 (0)     | -4.284                       | -3.563                       | -3.215                        | Cannot reject $H_0$                     |
| Meghalaya         | -2.514 (0)     | -4.284                       | -3.563                       | -3.215                        | Cannot reject $H_0$                     |
| Orissa            | -3.098 (6)     | -4.374                       | -3.603                       | -3.238                        | Cannot reject $H_0$                     |
| Punjab            | -0.034 (1)     | -4.297                       | -3.568                       | -3.218                        | Cannot reject $H_0$                     |
| Rajasthan         | -4.548* (0)    | -4.284                       | -3.563                       | -3.215                        | Reject $H_0$                            |
| Sikkim            | -2.600 (0)     | -4.284                       | -3.563                       | -3.215                        | Cannot reject $H_0$                     |
| Nagaland          | -1.538 (0)     | -4.284                       | -3.563                       | -3.215                        | Cannot reject $H_0$                     |
| Tamil Nadu        | -3.239*** (0)  | -4.284                       | -3.563                       | -3.215                        | Reject $H_0$                            |
| Tripura           | -1.955 (0)     | -4.284                       | -3.563                       | -3.215                        | Cannot reject $H_0$                     |
| Uttar Pradesh     | -1.594 (0)     | -4.284                       | -3.563                       | -3.215                        | Cannot reject $H_0$                     |
| West Bengal       | -1.406 (1)     | -4.297                       | -3.568                       | -3.218                        | Cannot reject $H_0$                     |

Note \*, \*\* and \*\*\* denote significance at 1, 5 and 10% levels. Critical values are from Mackinnon (1996)

statistics against which the null hypothesis has been tested, whereas columns 3, 4 and 5 show the Mackinnon critical values (1996) at 1, 5 and 10 level of significance, respectively. If the value of test statistics exceeds the critical values at any level of significance, then the null hypothesis is not to be rejected.

Table 8.4 shows that out of 24 states taken in the study, only seven displayed tendency towards convergence as the null hypothesis of non-convergence has been rejected for Gujarat and Rajasthan at 1% level of significance, for Assam and Maharashtra at 5% level of significance, whereas at 10% level for Bihar, Himachal Pradesh and Tamil Nadu. Various policies and programmes initiated by the government can be the reason for catching up of Gujarat with other states. Gujarat was among the first state to amend the Agricultural Produce Marketing Committee (APMC) Act which enabled farmers to directly sell their produce to wholesalers, exporters, industries and large trading companies without having to operate through commission agents. The state government has also pursued aggressive policies to promote diversification to high-value crops, especially fruit and vegetables and spices. Similarly, Rajasthan is the first state in the country to honour the progressive farmers. It got the first prize of Rs. 1 crore for the highest production of pulses in the country and proved that the desert state could also set new record through miraculous increase in production. The state government has made concrete efforts to help the farmers to improve the quality of soil, distribution of high breed seeds, fertilizers and for ensuring the optimal utilization of water in the agriculture sector. Bihar's success in catching up its economy is agrarian in nature and is the eighth largest food grain producer in the country. The government has become proactive in recent years.

Large interstate variations can be explained by multiple factors. It could be due to the initial conditions, and the policy bias of developing resource endowed regions first due to high returns on investment (Fan et al. 2000). The cost of production in poor states such as Bihar, Orissa, Uttar Pradesh, Rajasthan and Madhya Pradesh is very high as compared to Punjab, Haryana, Gujarat and the southern states. Also, the pattern of farming is not similar and it varies from region to region. While in Punjab, Haryana, Maharashtra and the southern states, it is more capital- and technology-intensive (centric), and Bihar, Uttar Pradesh and other BIMARU states are more labour-intensive. Infrastructure, procurement mechanisms, cooperative networks and credit flows also affect the cost of production. In all BIMARU states, these factors are not at par compared to the northern and southern states. Successful cooperative movements have brought substantial change in the rural economy of Gujarat and the southern states, which has given agro-business status to their agricultural sector.

One may also note that the benefits of agricultural growth have been concentrated in few states of India leaving the poorer states lagging further behind. The Green Revolution has increased interstate disparities across states, only the states of Punjab, Haryana and Western Uttar Pradesh showed higher output due to adoption of technologies under the Green Revolution. Equally important is the fact that government supported immensely in two north Indian states, viz. Punjab and Haryana through food procurement and price policy. Almost 75–80% of wheat going to central pool every year is sourced from Punjab and Haryana. The flow of credit to the farmers of Punjab, Haryana and southern states is easier and effectively operative as compared to the farmers of Bihar, Uttar Pradesh, Orissa, Rajasthan and Madhya Pradesh. Situation of rural cooperative banking system that lends for

agriculture and allied activities is very pathetic in all the BIMARU states. Basic infrastructure such as irrigation, roads, electrification, storage, access to markets and government procurement is far from satisfactory in these poor states. These factors may have contributed to disparities, and hence farm income exhibited divergence in NSDPA.

## 8.4 Conclusion

The study attempted to analyse the regional disparities in farm income from 1980 to 2011 using various convergence and divergence approaches. The result based on estimated cross-sectional unconditional  $\beta$ -convergence reveals that the NSDPA across the Indian states has been diverging over the period. The agricultural growth in richer states has been faster than the poorer states, resulting in an increasing inequality in farm income among the states. The evidence on conditional  $\beta$ -convergence shows that the states have different steady state levels and have tendencies to converge towards their own steady states. The speed of divergence is found to be low in different time periods. The physical capital has a positive effect on agricultural output growth, suggesting that in order to mitigate the gap between farm incomes across states, a more vigorous effort on infrastructural development is imperative. The lagging states could improve their growth performance by adopting farm policies, increase in investment so that the agricultural sector becomes more dynamic and productive and catch with the richer states in the north and south.

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# Chapter 9

## Income Mobility and Poverty Dynamics Across Social Groups in Rural India, 1993–2005

Amaresh Dubey and Arjan Verschoor

### 9.1 Introduction

India's primary objective since Independence in 1947 has been the eradication of mass poverty. At first, the strategy through which this objective was pursued combined an active role of the State in the economy with discouraging foreign trade and investment. This strategy had its intellectual roots in the widespread perception around Independence that British rule, and then in particular, exploitation by foreign capital and non-intervention in the economy by the State, was largely responsible for India's social ills (Roy 2002). With this strategy not obviously successful in terms of its primary objective, and under the influence of a global paradigm shift in thinking about development, India, as has most of the rest of South Asia and much of the developing world, has since the early 1990s abandoned its strategy of state interventionism and closed borders and has liberalised a good part of its internal and external trade.

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A part of the analysis in this chapter is based on India Human Development Survey, 2004–05. This survey was jointly organized by researchers at University of Maryland and the National Council of Applied Economic Research. The data collection was funded by grants R01HD041455 and R01HD046166 from the National Institutes of Health to University of Maryland. Part of the sample represents a resurvey of households initially conducted in the course of India Human Development Survey 1993–94 conducted by the NCAER.

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As is well-known, India's economy has grown fast since 1991, at a rate of 5.6% per annum, although it is doubtful whether this can be attributed to India's pro-market strategy, considering among other things that its growth rate during the 1980s was even somewhat higher, at 5.8% per annum (Kohli 2006, p. 1245). Growth has thus not accelerated since liberalisation. The same can be said about the rate of poverty reduction. Rural poverty fell by 0.73% points per annum in the post-reform period 1993–2005 but had fallen by 0.81% points per annum in the pre-reform period 1983–93. The difference is even somewhat larger for urban areas, in which poverty fell by 0.59% points per annum in the post-reform and 0.92 in the pre-reform period (Mahendra Dev and Ravi 2007; see also Himanshu 2007; Datt and Ravallion 2002).<sup>1</sup>

To be sure, India's social and economic achievements since Independence have been considerable. Its real per capita net national product more than tripled during the period 1950–2004; savings as a percentage of GDP have increased from about 9% in 1950–51 to about 32% in 2005–06; India has become self-sufficient in food grain production; its average life expectancy has doubled in the five decades since Independence, which also saw a significant decline in infant mortality, average literacy rates increasing by over three-and-a-half times, and even more impressively, female literacy increasing by close to six times.<sup>2</sup>

Although the origins of India's post-Independence social and economic achievements are thus in doubt (i.e. attribution to a pro-market strategy is problematic), there is no doubt about these achievements themselves. However, a pertinent question at this stage is whether the favourable movements in economic and social indicators that characterise the post-Independence era can continue into the future if persistent inequalities are not tackled. Jayaraman and Lanjouw (1999) review 35 longitudinal village studies for India and find that levels of wealth and income inequality remain high. Despite a general shift in attitudes towards caste-based social rankings, caste-based social and economic mobility remains largely limited to the middle and upper ends of the caste hierarchy. The upward mobility of low-caste households is not unheard of but still very unusual. The question is thus whether India's social and economic progress will be hindered by the persistence of pockets of rural poverty that have their origin in socially determined limits to social and economic mobility.

This chapter contributes somewhat to answering that question by documenting income mobility in the period 1993/94–2004/05 for selected social groups in rural India. For that purpose, one ideally needs panel survey data, which are still hard to come by for developing countries (cf. Rosenzweig 2003). Studies on economic mobility in India either use recall (e.g. Pal and Kynch 2000; Attwood 1979), one or more revisits of an individual village or group of villages surveyed earlier (e.g. Gaiha and Imai 2004; cf. Jayaraman and Lanjouw 1999), or the continuing survey

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<sup>1</sup>It is to be noted that the rate of poverty decline is a hotly debated issue in India. Therefore, the discussion here is about the trend and not the magnitude.

<sup>2</sup>All indicators listed here have been taken from the Economic Survey 2006–07 (GOI 2007).

of rural households collectively known as the Additional Rural Income and Rural Economic Development Surveys (ARIS-REDS) that began in 1968, was extended in 1971, the survey for which year became the baseline survey for resurveys in 1982 and 1999 (e.g. Bhide and Mehta 2004; Gaiha 1988).

Until recently, the REDS have been the only panel surveys for which the baseline survey was designed to be representative for the rural population of most of India's major states. However, we use a new longitudinal data set, based on the Human Development Profile of India (HDPI) surveys that meet the same requirement. Its advantage over the REDS for our purposes is that it covers the period 1993/94–2004/05, India's post-reform period, during which it adopted a pro-market strategy, whereas the two latest REDS rounds are in 1982 and 1999.

Inequality in India fell during the 1980s and rose during the 1990s (Mahendra Dev and Ravi 2007), and the periods differ sharply in terms of India's economic development strategy. Therefore, there is a clear advantage in studying income mobility in a panel, in which effects of the two periods are not conflated. Moreover, the period covered by the panel survey data set that we use coincides with the two most recent *comparable* National Sample Survey Organisation (NSSO) Consumer Expenditure Surveys (CES), if one sets aside the controversial 55th round of 1999–2000 (cf. Himanshu 2007). We are thus in principle in a position to document the income mobility, the “churning under the surface” that underlies the most recent aggregate changes in poverty that the NSSO data allow one to compute.

This has clear advantages, both for understanding the nature of poverty and for policy designed to alleviate it. A repeated cross section (as in the NSSO CES) is unable to pronounce on the movements in and out of poverty that correspond with overall poverty changes. For understanding poverty and for anti-poverty policy, it matters whether the poor in the later period are largely the same people as the poor in the earlier period, or whether many have swapped places, whereas repeated cross sections are unable to ascertain the degree to which poverty is a transitory phenomenon. Given a legitimate research interest in the income mobility and in the persistence of poverty across social groups in rural India, during the period in which it has pursued a pro-market strategy, a representative panel survey for that period is an obvious bonus.

Panel data are thus suitable for studying income mobility that repeated cross sections are blind to but come with their own problems. First of all, one tends to find rather a lot of income mobility in panel survey data, which may simply reflect that income is a volatile variable and that the poorest do remarkably well, which may simply be a matter of mean reversion. Moreover, measurement error plays a potentially confounding role (cf. Fields et al. 2003; Baulch and Hoddinott 2000). Our approach to these and related problems is to assume that they do not vary systematically across social groups, so that the comparison between them remains valid.

The remainder of the chapter is organised as follows. Section 9.2 describes the data set used for the analysis. Section 9.3 contains descriptive statistics, including ones that allow comparison between our poverty estimates and the ones based on the contemporary NSSO CES data. Section 9.4 reports an all-India transition

matrix, to facilitate comparison with related studies of *relative* income mobility, and an analysis by social group of *absolute* income gains, which is more pertinent to our research question. Section 9.5 concludes.

## 9.2 Data

The data reported here are derived from two large-scale household surveys that cover most of the territory of India. The first round, HDPI-I, took place in 1993/94 and was carried out by India's National Council of Applied Economic Research (NCAER) on behalf of the UNDP. The second round, HDPI-II, took place in 2004/05 and was carried out by the NCAER on behalf of the University of Maryland. The primary purpose of the surveys was to collect detailed information on a large range of human development indicators, including income, which is the variable reported here. The subdivision of social groups in the questionnaires for both survey rounds allows us to consider Dalits (Scheduled Castes), other Hindus, Adivasis (Scheduled Tribes), Muslims and members of other religions in the analysis.

About one-third of households in the first round have been resurveyed in the second round, which leaves us with a usable panel of 9,145 households. The panel is in its base year meant to be representative for the rural areas of 14 of India's 17 major states: Andhra Pradesh, Bihar, Gujarat, Haryana, Himachal Pradesh, Kerala, Madhya Pradesh, Maharashtra, Orissa, Punjab, Rajasthan, Tamil Nadu, Uttar Pradesh and West Bengal, with the remaining states and smaller territories, although usually covered in at least one of the two cross sections, not part of the usable panel.

The sampling strategy of the resurvey uses a residence-based sampling rule, which is known to create biases, and in particular to underestimates of economic mobility (Rosenzweig 2003; Baulch and Hoddinott 2000). As before, we deal with the problem by assuming that the income mobility of all social groups is equally affected by it, and by focusing primarily on the comparison between groups rather than on estimates of absolute mobility.

## 9.3 Descriptive Statistics

We start with a comparison of poverty headcount ratios for rural India according to the NSSO Consumer Expenditure Surveys, 50th round and 61st round, and according to the Human Development Profile for India (HDPI) surveys, round 1 (HDPI-I) and round 2 (HDPI-II), carried out by the NCAER. The reason is that we are interested in the income mobility, the "churning under the surface" that underlies aggregate poverty changes, using the panel households in the HDPI surveys, so we first wish to get a sense of how well we are able to approximate the

**Table 9.1** Poverty headcount ratio (HCR) by state in rural India, 1993/94 and 2004/05: NSSO (CES) and NCAER (HDPI-I and HDPI-II)

| State            | NSS 1993–94   |             | NSS 2004–05   |             | NCAER 1993–94 |             | NCAER 2004–05 |             |
|------------------|---------------|-------------|---------------|-------------|---------------|-------------|---------------|-------------|
|                  | Freq.         | HCR         | Freq.         | HCR         | Freq.         | HCR         | Freq.         | HCR         |
| Andhra Pradesh   | 4,918         | 15.9        | 5,555         | 10.5        | 2,100         | 20.8        | 1,519         | 7.3         |
| Assam            | 3,214         | 45.2        | 3,350         | 22.1        | 1,233         | 31.3        | 696           | 32.0        |
| Bihar            | 7,034         | 57.7        | 6,733         | 43.4        | 2,155         | 44.7        | 1,478         | 29.7        |
| Gujarat          | 2,241         | 22.2        | 2,320         | 18.9        | 1,606         | 37.0        | 1,290         | 15.4        |
| Haryana          | 1,041         | 28.0        | 1,680         | 13.2        | 1,722         | 24.9        | 1,343         | 14.2        |
| Himachal Pradesh | 1,879         | 30.4        | 2,143         | 10.5        | 1,225         | 42.5        | 1,054         | 6.0         |
| Karnataka        | 2,620         | 30.1        | 2,880         | 20.7        | 2,523         | 38.1        | 2,558         | 18.8        |
| Kerala           | 2,572         | 25.3        | 3,300         | 13.2        | 1,474         | 29.1        | 1,085         | 17.0        |
| Madhya Pradesh   | 5,333         | 40.9        | 5,835         | 37.9        | 4,162         | 36.9        | 2,997         | 53.7        |
| Maharashtra      | 4,442         | 38.1        | 5,014         | 29.6        | 2,765         | 30.2        | 2,192         | 29.8        |
| Orissa           | 3,355         | 49.9        | 3,836         | 46.9        | 1,971         | 52.7        | 1,463         | 53.7        |
| Punjab           | 2,061         | 11.5        | 2,433         | 9.0         | 1,303         | 30.1        | 1,043         | 6.0         |
| Rajasthan        | 3,106         | 26.3        | 3,541         | 18.3        | 1,984         | 42.2        | 1,583         | 29.1        |
| Tamil Nadu       | 3,907         | 32.9        | 4,159         | 23.0        | 1,456         | 30.8        | 1,042         | 26.7        |
| Uttar Pradesh    | 9,042         | 42.2        | 9,333         | 33.7        | 4,036         | 41.9        | 2,589         | 34.1        |
| West Bengal      | 4,509         | 41.2        | 4,988         | 28.4        | 1,515         | 56.3        | 1,254         | 29.5        |
| <i>Total</i>     | <i>61,274</i> | <i>37.1</i> | <i>67,100</i> | <i>28.4</i> | <i>33,230</i> | <i>38.3</i> | <i>25,186</i> | <i>29.0</i> |

*Sources* Own computations based on NSSO Consumer Expenditure Surveys (CES), 50th and 61st rounds, the NCAER Human Development Profile for India (HDPI) surveys, 1993/94 and 2004/05, using the official poverty line as reported by the Planning Commission, Government of India

*Note* Poverty figures based on number of poor individuals

poverty changes that one is able to compute using the most authoritative data set for that exercise. As indicated before, the NSSO 50th and 61st rounds are the two most recent *comparable* surveys on which all-India and state-wise poverty estimates may be based, and their years, 1993/94 and 2004/05, are identical to the years in which the HDPI surveys have been implemented.

Table 9.1 thus gives poverty figures for the years 1993/94 and 2004/05 based on our own computations using two different sources. In both cases, we use the official Government of India poverty line. The key difference between the two sources is that in the one case, NSS data, expenditures have been used, and in the other, the NCAER data, income, since we do not have reliable expenditure figures for both rounds. As per the current practice, the poverty figures are based on the number of individuals, not the number of households that have income or expenditure below

the official poverty line.<sup>3</sup> For the NCAER data, we use all individuals in the surveys, not just the ones in the panel.

For all rural India, poverty changes are very similar according to the two different sources. The NSS data suggest that the poverty headcount ratio has declined from 37.1% of the population to 28.4% between 1993/94 and 2004/05; the NCAER data that it has declined from 38.3 to 29.0%. The comparability of the two sources is not quite as good when we look at individual states. The focus here is on the 14 states for which we have panel data, that is, for which the comparison matters for present purposes. Out of those 14 states, the direction of the poverty change, that is, whether it is positive or negative, is identical in 12 cases. However, for seven states the difference between the poverty changes across the two sources is more than 5% points. In one case, Punjab, the difference is as much as 22% points, whereas for six states the difference is of the order of magnitude of about 10% points. For the remaining seven states, the difference between the poverty changes implied by the two different sources is less than 5% points.

It is tempting to speculate about the reasons for these rather large differences. The most obvious candidate for explaining this would be the fact that in the one case, income has been used and in the other expenditures. However, this would take us outside the scope of the current exercise. It is at any rate an interesting comment on the sensitivity of poverty measurement to different welfare indicators and, possibly, different sources, even though both are designed to be representative. For present purposes, it is sufficient to note that, whereas the point estimates of poverty changes are not always comparable across the two different sources at a more disaggregated level than all rural India, the directions of change are reasonably comparable. This is an important qualification to the analysis presented in the remainder of the chapter.

The purpose of the analysis here is to understand the income mobility and poverty dynamics that underlie aggregate poverty changes by social group. Table 9.2 reports real income changes and poverty changes by social group between 1993/94 and 2004/05 for the households that are in the HDPI panel. These are thus the changes that potentially mask the income mobility and poverty dynamics that the remainder of the analysis will focus on.

All social groups exhibit healthy income growth. On average, real per capita income increases by 4.2% per annum. Although differences across groups are not large, it is noteworthy that the best-performing group are the Dalits, at 5.2% real per capita income growth per annum, followed by the high-caste Hindus and Adivasis (both 4.0%), the Muslims (3.8%) and members of other religions (3.5%). Note here and throughout that the sample size on which figures for members of other religions are based is too small (76) to place much confidence in them. There are thus no striking differences across groups, and the real per capita income changes do

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<sup>3</sup>When we compute income mobility we use number of households, for reasons that will become apparent.

**Table 9.2** Poverty and real income changes by social group, 1993/94–2004/05

|                                              | Adivasis | Dalits | High-caste Hindus | Muslims | Other religions | Total |
|----------------------------------------------|----------|--------|-------------------|---------|-----------------|-------|
| Round 1 mean per capita income <sup>a</sup>  | 3,219    | 3,537  | 5,689             | 3,960   | 5,511           | 4,818 |
| Round 2 mean per capita income <sup>a</sup>  | 4,954    | 6,175  | 8,737             | 5,953   | 8,072           | 7,562 |
| Annual change (%)                            | 4.0      | 5.2    | 4.0               | 3.8     | 3.5             | 4.2   |
| Round 1 poverty headcount ratio <sup>b</sup> | 49.8     | 45.2   | 28.1              | 45.6    | 26.3            | 35.5  |
| Round 2 poverty headcount ratio <sup>b</sup> | 26.9     | 25.1   | 19.2              | 30.1    | 25.0            | 22.2  |
| Annual change (ppt)                          | –2.1     | –1.8   | –0.8              | –1.4    | –0.1            | –1.2  |
| <i>N</i>                                     | 795      | 2,175  | 5,341             | 758     | 76              | 9,145 |

*Source* Own calculations based on observations for the panel households in the Human Development Profile for India (HDPI) surveys for 1993/94 (HDPI-I) and 2004/05 (HDPI-II)

*Notes* <sup>a</sup>Mean annual per capita income in constant 1993/94 prices

<sup>b</sup>Based on number of poor households (to ensure correspondence with subsequent analysis)

certainly not provide any basis for claiming that income growth in rural India has left the more disadvantaged groups (even further) behind.

The same can be said with even more force when looking at changes in the poverty headcount ratios, by social group, also reported in Table 9.2. Unlike in Table 9.1, the poverty figures reported in Table 9.2 are based on the panel households only and computed using the number of poor households rather than the number of poor individuals—this is to ensure comparability with the analysis that follows.

In 1993/94, Adivasis are the poorest group, with a poverty headcount ratio of 49.8%, followed by Muslims (45.6%), Dalits (45.2%), high-caste Hindus (28.1%) and members of other religions (26.3%). It is perhaps somewhat surprising that members of other religions do better than high-caste Hindus. However, we have noted that the sample size of the former group is small. Moreover, the group of high-caste Hindus consists of two groups here: forward-caste Hindus and members of what are known as “Other Backward Classes” (OBCs). It is of course far from desirable to have these two groups clubbed together, but we are forced to do so because of the subdivision of social groups that the questionnaires in HDPI-I contain.

In 2004/05, Muslims are the poorest group, with a poverty headcount ratio of 30.1%, followed by Adivasis (26.9%), Dalits (25.1%), members of other religions (25.0%) and high-caste Hindus (19.2%). Leaving aside the reversal in ranks between high-caste Hindus and members of other religions for the reasons discussed, the most notable change in the ranking of social groups according to their poverty headcount ratio between 1993/94 and 2004/05 is that Muslims are now the

poorest group. Their poverty headcount ratio has fallen from 45.6 to 30.1%, but that of Adivasis, the previous poorest group has fallen even more, from 49.8 to 26.9%.

Indeed, annualised changes in the poverty headcount ratio by social group (Table 9.2) reveal that poverty has fallen most for the Adivasis, at 2.1% points per annum, followed by Dalits (1.8% points), Muslims (1.4), high-caste Hindus (0.8) and members of other religions (0.1). Poverty has fallen by more than the average of 1.2% points per annum for the relatively disadvantaged groups—Muslims, Dalits, Adivasis—and by less than 1.2% points per annum for the relatively advantaged high-caste Hindus.

Both when observing real income changes and when observing poverty changes by social group in the HDPI panel, one is tempted to conclude that, during the years of India's pro-market strategy, disadvantaged groups in rural areas have benefited at least as much, and if anything, more than advantaged groups. In the next section, it will become apparent that a much more nuanced picture emerges when one studies the income mobility and poverty dynamics that underlie these changes.

## 9.4 Income Mobility and Poverty Dynamics

The focus of the analysis reported on here is on the income mobility and poverty dynamics that underlie the aggregate changes reported on above. A standard tool for computing relative income mobility is that of a transition matrix. Percentages are computed of households that were in quintile *X* in round 1 and that are in quintile *Y* in round 2. These figures are about relative income mobility only and do not give any insight into absolute income gains, in particular move in and out of poverty. We therefore analyse these separately.

Table 9.3 reports on inter-quintile movements of rural households ranked by per capita income between 1993/94 and 2004/05, or between HDPI-I and HDPI-II. In line with other studies of household economic mobility (reviewed in Baulch and Hoddinott 2000), the table reveals a great deal of such mobility. Because of the interest of this chapter in the persistence of poverty, we are especially interested in what happens to panel households that in HDPI-I are in the bottom quintile. As much as 30.3% of such households are also in the bottom quintile in HDPI-II.

This figure is rather high compared to that reported in longer-term studies of economic mobility, at least those that make use of income changes. The only studies that we found that allow for a direct comparison with the results reported here are studies for individual Indian villages.<sup>4</sup> Swaminathan (1991a, b) reports for a village in south India for the period 1977–85 a percentage of households in the bottom quintile that remain there over time of 52.9%, but land is used as the welfare measure. Lanjouw and Stern (1991, 1993), using income, report for a village in

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<sup>4</sup>Gaiha (1988) reports a transition matrix for the period 1968–71 so should not be considered a longer-term study.



**Table 9.3** Inter-quintile movements (%) of rural households ranked by per capita income, 1993/94–2004/05

| Quintiles 1993/94 | Quintiles 2004/05 |      |      |      |      |
|-------------------|-------------------|------|------|------|------|
|                   | Q1                | Q2   | Q3   | Q4   | Q5   |
| Q1                | 30.3              | 28.1 | 21.1 | 13.2 | 7.3  |
| Q2                | 21.2              | 25.3 | 24.9 | 18.7 | 9.9  |
| Q3                | 18.6              | 20.4 | 23.5 | 22.4 | 15.2 |
| Q4                | 16.8              | 16.3 | 19.1 | 23.1 | 24.8 |
| Q5                | 13.2              | 9.9  | 13.5 | 20.4 | 42.9 |

*Source* As for Table 9.2

*Note* Figures are percentages of households in the row quintile in HDPI-I that are in the column quintile in HDPI-II

north India (the famous Palanpur) 26.3% for the period 1957/58–1962/63, 15.8% for the period 1962/63–1974/75 and 17.4% for the period 1974/75–1983/84. The figure we find for households stuck in the bottom quintile is thus on the high side compared to these village studies, although perhaps not outrageously so.

The percentage of households in the bottom quintile in HDPI-I that move by one quintile is 28.1%, whereas Swaminathan finds 17.6%, and Lanjouw and Stern between 21.7 and 26.3% for their three periods—the figure we find is thus of the same order of magnitude. The percentage of households in the bottom quintile in round 1 that move by two or more quintiles is 41.6, whereas Swaminathan finds 29.5, and Lanjouw and Stern between 47.4 and 60.9%. The figure we find is on the low side, but again not outrageously so.

Looking at overall income mobility, 29.0% of households remain on the diagonal (48.2 in Swaminathan, and between 23.0 and 25.6 in Lanjouw and Stern), 22.7% move by one quintile (36.5 in Swaminathan, and between 31.0 and 44.9 in Lanjouw and Stern) and 14.5% of households move by two or more quintiles (15.3 in Swaminathan, and between 24.5 and 46.0 in Lanjouw and Stern). However, since this is about relative income mobility, nothing may be concluded from this about the persistence of absolute poverty.

For considering the persistence of absolute poverty and its variability across groups, Table 9.4 reports poverty dynamics by social group between 1993/94 and 2004/05 for the 9,145 panel households that have been surveyed in HDPI-I and resurveyed in HDPI-II. The first panel of the table presents conditional probabilities: that a household that belongs to category *X* belongs to group *Y* (figures not in parentheses) and that a household that belongs to group *Y* belongs to category *X* (figures in parentheses). In addition to the categories “poor in round 1”, “not poor in round 1”, “poor in round 2” and “not poor in round 2”, four new, mutually exclusive and exhaustive categories are considered: the “never poor” are households that neither are poor in round 1 nor in round 2; the “new poor” are not poor in round 1 and poor in round 2; the “still poor” are poor in both rounds; and the “no longer poor” are poor in round 1 and not in round 2. These categories can be devised because we have panel data and allow us to study the poverty dynamics that underlie the aggregate poverty changes reported in Table 9.2.

**Table 9.4** Poverty dynamics by social group, 1993/94–2004/05: conditional probabilities (%) and odds ratios

| Category/group                   | Adivasis    | Dalits      | High-caste Hindus | Muslims     | Other religions | Total      | N     |
|----------------------------------|-------------|-------------|-------------------|-------------|-----------------|------------|-------|
| <i>Conditional probabilities</i> |             |             |                   |             |                 |            |       |
| Never poor                       | 6.3 (38.1)  | 19.4 (42.9) | 67.0 (60.5)       | 6.5 (41.3)  | 0.9 (56.6)      | 100 (52.8) | 4,826 |
| New poor                         | 8.9 (12.1)  | 24.0 (11.9) | 56.6 (11.4)       | 9.2 (13.1)  | 1.2 (17.1)      | 100 (11.7) | 1,074 |
| Still poor                       | 12.3 (14.8) | 30.1 (13.2) | 43.4 (7.8)        | 13.5 (17.0) | 0.6 (7.9)       | 100 (10.5) | 956   |
| No longer poor                   | 12.1 (35.0) | 30.4 (32.0) | 47.4 (20.3)       | 9.4 (28.6)  | 0.6 (18.4)      | 100 (25.0) | 2,289 |
| Poor round 1                     | 12.2 (49.8) | 30.3 (45.2) | 46.2 (28.1)       | 10.7 (45.6) | 0.6 (26.3)      | 100 (35.5) | 3,245 |
| Not poor round 1                 | 6.8 (50.2)  | 20.2 (54.8) | 65.1 (71.9)       | 7.0 (54.4)  | 0.9 (73.7)      | 100 (64.5) | 5,900 |
| Poor round 2                     | 10.5 (26.9) | 26.9 (25.1) | 50.4 (19.2)       | 11.2 (30.1) | 0.9 (25.0)      | 100 (22.2) | 2,030 |
| Not poor round 2                 | 8.2 (73.1)  | 22.9 (74.9) | 60.7 (80.8)       | 7.4 (69.9)  | 0.8 (75.0)      | 100 (77.8) | 7,115 |
| Total                            | 8.7 (100)   | 23.8 (100)  | 58.4 (100)        | 8.3 (100)   | 0.8 (100)       | 100 (100)  | 9,145 |
| <i>Odds ratios</i>               |             |             |                   |             |                 |            |       |
| Never poor                       | 0.40        | 0.49        |                   | 0.46        | 0.85            |            | 4,826 |
| New poor                         | 1.07        | 1.05        |                   | 1.17        | 1.61            |            | 1,074 |
| Still poor                       | 2.07        | 1.81        |                   | 2.43        | 1.02            |            | 956   |
| No longer poor                   | 2.11        | 1.84        |                   | 1.57        | 0.89            |            | 2,289 |
| Poor round 1                     | 2.54        | 2.11        |                   | 2.15        | 0.91            |            | 3,245 |
| Poor round 2                     | 1.55        | 1.41        |                   | 1.82        | 1.41            |            | 2,030 |
| N                                | 795         | 2,175       | 5,341             | 758         | 76              |            | 9,145 |

Source As for Table 9.2

Notes Conditional probabilities not in parentheses denote the probability that a panel household that belongs to category *X* belongs to group *Y*; conditional probabilities in parentheses denote the probability that a panel household that belongs to group *Y* belongs to category *X*. Odds ratios are the ratio of the odds that members of group *Y* ( $\neq$  high-caste Hindus) belong to category *X* to the odds that high-caste Hindus belong to category *X*

Overall we find that 10.5% of households are poor both in 1993/94 and in 2004/05. This figure is very low. Bhide and Mehta (2004) using the NCAER REDS report that 53% of households are poor in both rounds, with the first round being 1970/71 and the second one 1981/82. This suggests that in the era of India's pro-market development strategy, chronic poverty has declined massively.

We next look at poverty dynamics by social group, ignoring because of a small sample size of the group "members of other religions". As much as 12.3% of the chronically poor are Adivasis, 30.1% Dalits, 43.4% high-caste Hindus and 13.5% Muslims. Most of the chronically poor (55.9%) are thus from disadvantaged groups, but high-caste Hindus are the single largest group. The latter reflects population size of course: Muslims have the highest proportion of chronic poverty (17.0%), followed by Adivasis (14.8), Dalits (13.2) and high-caste Hindus (7.8%).

Whereas the likelihood of being chronically poor is thus considerably higher for the disadvantaged groups, predictably the opposite is true for the category "never poor": about 60% of high-caste Hindus is not poor in either round, whereas the figure hovers around 40% for each of the three disadvantaged groups. For the category "new poor", not much difference is found across groups. However, there is a striking pattern across conditional probabilities of being "no longer poor": 35.0%

of Adivasis are in this category, 32.0 of Dalits, 28.6 of Muslims and 20.3% of high-caste Hindus.

The finding reported in Table 9.2 that disadvantaged groups have experienced faster poverty reduction than high-caste Hindus to a degree masks a higher incidence of chronic poverty among disadvantaged groups compared to high-caste Hindus that is compensated for by a larger proportion of these groups that have escaped from poverty compared to high-caste Hindus. The second panel in Table 9.4 formally confirms this. Odds ratios are presented that are defined here as the ratio of the odds that members of a group other than high-caste Hindus experience an event to the odds that high-caste Hindus experience that same event. Odds ratios are close to one for the category “new poor”, substantially lower than one for the “never poor” and substantially higher both for the category “still poor” and for the category “no longer poor”. Disadvantaged groups are more likely than high-caste Hindus both to experience chronic poverty and to experience exiting poverty.

Both chronic poverty and exiting poverty are thus substantially more likely for disadvantaged groups—Adivasis, Dalits and Muslims—which underlies, and to some extent is hidden by, their faster poverty reduction as documented in Table 9.2. That table also documents mean annual per capita real income growth, 3.8% for Muslims, 4.0% for high-caste Hindus, 4.0% for Adivasis and 5.2% for Dalits, which over the entire period translates into slightly over 50% income growth for Muslims, high-caste Hindus and Adivasis, and some 75% for Dalits. These averages hide substantial disparities across categories (Table 9.5). The chronically poor experienced income growth of 14.4% on average, ranging from 2.7% for Muslims to 19.7% for Dalits; those that slipped into poverty income growth of −63.7% on average, ranging from −68.2% for Muslims to −54.5% for Dalits; and those that exited poverty income growth of 313.0% on average, ranging from 221.3% for Adivasis to 380.0% for high-caste Hindus. Two things are worth noting about these figures. First, there are very large differences in mean income growth across categories. Second, although Dalits exhibit superior income growth to other groups in the aggregate as well as among the chronically poor and the new poor, they do not do so in the group that has escaped from poverty.

**Table 9.5** Poverty dynamics and real income changes (%) by social group (1993/94–2004/05)

|                   | Adivasis | Dalits | High-caste<br>Hindus | Muslims | Other<br>religions | Total |
|-------------------|----------|--------|----------------------|---------|--------------------|-------|
| Still poor        | 16.7     | 19.7   | 14.7                 | 2.7     | −9.9               | 14.4  |
| New poor          | −61.6    | −54.4  | −65.6                | −68.2   | −78.7              | −63.7 |
| No longer<br>poor | 221.3    | 261.6  | 380.0                | 265.6   | 305.5              | 313.0 |
| N                 | 795      | 2,175  | 5,341                | 758     | 76                 | 9,145 |

Source As for Table 9.2

Note Figures are percentage changes in mean real per capita income (i.e. in constant 1993/94 prices) of panel households between HDPI-I and HDPI-II for selected groups and categories

## 9.5 Conclusion

We have studied income mobility and poverty dynamics across social groups in rural India for the period 1993/94–2004/05, during which India pursued a pro-market development strategy. The data set used yields poverty estimates that are reasonably comparable with poverty estimates using conventional sources, although for individual states there are sometimes large differences. The advantage of the data set used is that a large number of households are identical in both rounds, so that the trajectories of individual households may be followed.

We find evidence for considerable income growth that does not differ markedly across social groups, and for considerable relative income mobility. Poverty reduction has been fastest for the least advantaged groups—Muslims, Dalits and Adivasis. Analysis of the poverty dynamics that underlie these changes suggests that these groups are disproportionately present among those who exit poverty and among the chronically poor. Aggregate poverty changes based on repeated cross sections cannot reveal such nuance, which demonstrates the advantage for poverty analysis of being able to use panel data.

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# Chapter 10

## Is Occupational Transformation in India Pro-Poor? Analysis of Rural Labour Market in the Reform Period

Amaresh Dubey and Shivakar Tiwari

### 10.1 Background of the Study

Theoretical and empirical literature holds that in the initial stage of economic development labour markets remain predominantly rural and large share of population depends on agricultural or traditional occupation for livelihood. As development proceeds, non-farm diversification of workforce results in shift from agricultural/primary activities to non-agricultural activities (Lewis 1954; Ranis and John 1961) and movement of workers to non-agriculture sector results in augmentation of overall per worker productivity which contribute to economic growth and poverty reduction (MacMillian and Rodrik 2011). However, shift of workers away from agriculture is not always due to pull force of relatively higher wages in the modern sector but also due to push conditions in the traditional sector and expected earnings in the modern sector (Todaro 1969). Further, as per human capital theory, the earnings and occupation nature of workers in the modern sector depend not only on the availability of employment opportunities, which of course is crucial, but also on the human capital base of the workers (Becker 1964). Decent occupational choice/pattern as well as the earnings is positively correlated with the human capital (Becker 1993). As Schultz (1980) mentioned:

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...The decisive factor of production in improving the welfare of the poor are not space, energy and cropland; the decisive factors is the improvement in the population quality. (Schultz 1980)

In India, non-farm diversification of employment remained stagnant for a long period and started at the slower rate in the late 1970s. Process speeded up further in the period since post-reform, more so in the period since 2004–05 (Himanshu and Lanjouw 2016; Kumar 2016). Between 2004–05 and 2011–12, at the aggregate level, the share of workers in the agricultural and allied sectors reduced to less than 50% and declined in absolute terms with the subsequent increase in the non-farm sectors.

Even though, in India, non-farm occupational diversification has occurred at faster pace with rising urban population, understanding rural labour dynamics becomes more crucial for improving welfare of the poor population particularly in rural area. To take a snapshot view, in 2011–12, according to the erstwhile Planning Commission estimate based on official poverty (Tendulkar Committee recommended), around 80% of total poor of total 269 million are living in the rural area. In rural area, agriculture still remains the mainstay of the rural economy as around 65% of total workforce is still dependent on agriculture in the form of self-employment and as casual wage labourer (NSSO 2014). Lastly, employment generated in the non-farm sector has been mostly in construction activities and is casual in nature.

In this context, the major focus of the study, along with the long-run trend of structural transformation of workforce, is examining the evolving pattern of occupational transformation in the period between 2004–05 and 2011–12. By using the thick round of national sample survey (NSS) on employment–unemployment survey (EUS), it has been attempted to analyse the pro-poor and distributive implications of the non-farm diversification in the rural area from the perspective of social inclusion. Determinant of occupational access of individual in rural area has been intensively analysed through multinomial model estimated by maximum likelihood method. Trends in the share of non-farm employment across income quintile are examined through odds ratio.

The remaining part of chapter is framed in five sections. Section 10.2 sketches trends in workforce transformation from farm to non-farm sector at the aggregate all India level. Further, Sect. 10.3 analyses the association between household livelihood, education level and standard of living in rural area. Focus of Sect. 10.4 is the important role of employment status and income level. Results of multinomial model with average predicted probabilities have been discussed in Sect. 10.5, which is followed by the summary observations in Sect. 10.6.

## 10.2 Non-Farm Diversification: Trends and Pattern

Non-farm diversification shows evolving dynamism in the rural labour market (Kijima and Lanjouw 2005). Occupational structure in India remained predominantly agricultural for a long period, which started showing some declining trend since the mid-1980s (Himanshu and Lanjouw 2016). However, in the 1990s, the

share of non-farm sector did not expand. But the rate of decline in farm employment has increased since 1999–2000, which got accelerated in the latest reform period between 2004/05 and 2011/12. Interestingly, for the first time, at the aggregate level, size of workforce in agricultural sector has declined in absolute terms and its share has fallen below 50%. Even though non-farm employment share has increased in both rural and urban areas; however, in the former the share of agricultural workforce has been still higher that was around 65% in 2011/12. The share of non-farm employment has been growing with the share in the secondary sector increasing at faster rate than the services in rural India.

Although the employment share in non-primary sector has increased, on the contrary, growth in rural jobs has been stagnant in the period between 2004/05 and 2011/12. In fact, workforce size has declined slightly by around one million in absolute figure. The decline has come predominantly from farm sector (29 million) with relatively lesser increase in non-farm employment (28 million).<sup>1</sup> Also, it is for the first time in post-Independence period that workforce in the rural area has declined in absolute numbers. Against this, in the period between 1993/94 and 2004/05, of the total 50 million additional rural jobs created, around 30 million were in non-farm sectors while 20 million in the farm sector (Table 10.1). So, in absolute terms, not only employment in farm sector has declined but the increase in the non-farm employment has been slightly lower.<sup>2</sup> However, the per annum growth rate of non-farm employment has been higher that was around 4% in this period against 3.7% in the period between 1993/94 and 2004/05.

As argued in the literature (Lanjouw and Shariff 2004; Kijima and Lanjouw 2005), the expansion of the non-farm sector, particularly in manufacturing casual wage employment, will have larger poverty impact. But, disaggregated employment data at the broad industry group (Table 10.2) shows that construction has been the major avenue of employment generation, which absorbed all moving out agriculture workers. It has been found true for both male and female workers in the period between 2004/05 and 2011/12. The workforce size in construction sector has increased more than twofold from 16 million in 2004/05 to 37 million in 2011/12. Out of this, size of female workforce has increased by 4 million while for male workforce the increase has been by 17 million. Thus, decline in agricultural workforce has been primarily of female as the size of female and male workers declined by around 25 million and 3 million, respectively.

Further decline in female participation in economic activity is clear from industry-level observation given in Table 10.2. Except in construction (wage and salaried job) and other community and social services, which are mostly regular public sector job, share of female workers has declined in all industries of the labour

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<sup>1</sup>Compound annual growth rate of non-farm employment has declined in urban area from 3.7% in the period between 1993/94 and 2004/05 to the rate of 2.7% in the period between 2004/05 and 2011/12.

<sup>2</sup>Here, the source of increase in non-farm employment in the rural area has not been analysed. Presumably, it may be the result of both dynamism in the rural economy and demand for employment generated in the urban vicinity.



**Table 10.1** Sectoral-level trends in workforce in reform period

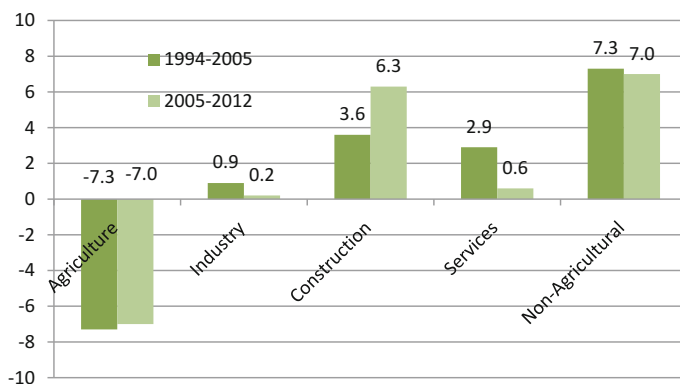
| Sector      | 1983             | 1993–94 | 2004–05 | 2011–12 | 1983                | 1993–94 | 2004–05 | 2011–12 |
|-------------|------------------|---------|---------|---------|---------------------|---------|---------|---------|
|             | Percentage share |         |         |         | Workforce (million) |         |         |         |
| Rural       |                  |         |         |         |                     |         |         |         |
| Agriculture | 81.21            | 78.5    | 72.8    | 64.5    |                     | 228     | 247.5   | 218.7   |
| Industry    | 8.85             | 10.1    | 13.5    | 20.3    |                     | 27.2    | 44      | 66.4    |
| Services    | 9.94             | 11.5    | 13.7    | 15.2    |                     | 33.1    | 46.1    | 51.3    |
| Total       | 100              | 100     | 100     | 100     |                     | 288.3   | 337.6   | 336.4   |
| Urban       |                  |         |         |         |                     |         |         |         |
| Agriculture | 14.59            | 13.5    | 9.6     | 7.5     |                     | 10.8    | 11      | 10.2    |
| Industry    | 32.69            | 30.9    | 33.2    | 34.1    |                     | 24.8    | 38.1    | 46.4    |
| Services    | 52.71            | 55.6    | 57.3    | 58.5    |                     | 44.7    | 65.8    | 79.7    |
| Total       | 100              | 100     | 100     | 100     |                     | 80.3    | 114.9   | 136.3   |
| Total       |                  |         |         |         |                     |         |         |         |
| Agriculture | 67.93            | 64.8    | 57.1    | 48.4    |                     | 238.8   | 258.5   | 228.9   |
| Industry    | 13.6             | 14.1    | 18.1    | 23.9    |                     | 52      | 82      | 112.8   |
| Services    | 18.46            | 21.1    | 24.7    | 27.7    |                     | 77.8    | 111.9   | 130.9   |
| Total       | 100              | 100     | 100     | 100     |                     | 368.6   | 452.4   | 472.6   |

Source calculated from unit record NSS data, various rounds

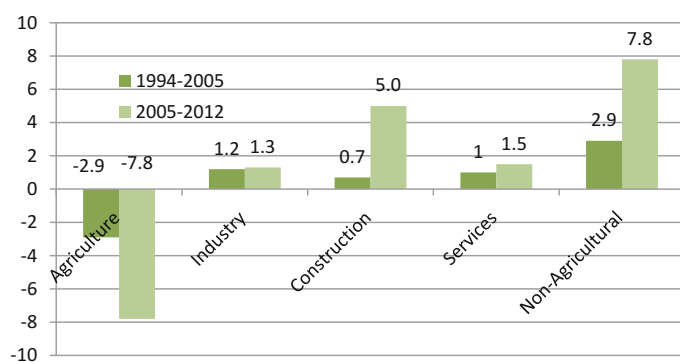
**Table 10.2** Change in activity status across industries (one-digit NIC): male and female

|               | 2004–05 |      |      |      | 2011–12 |      |      |      |
|---------------|---------|------|------|------|---------|------|------|------|
|               | SE      | REG  | CAS  | ALL  | SE      | REG  | CAS  | ALL  |
| <i>Male</i>   |         |      |      |      |         |      |      |      |
| AGR           | 0.73    | 0.10 | 0.71 | 0.67 | 0.72    | 0.05 | 0.56 | 0.60 |
| MQ            | 0.00    | 0.01 | 0.01 | 0.01 | 0.00    | 0.01 | 0.01 | 0.01 |
| MANU          | 0.07    | 0.20 | 0.06 | 0.08 | 0.07    | 0.25 | 0.06 | 0.08 |
| EWU           | 0.00    | 0.02 | 0.00 | 0.00 | 0.00    | 0.02 | 0.00 | 0.00 |
| CTT           | 0.02    | 0.02 | 0.17 | 0.07 | 0.02    | 0.03 | 0.33 | 0.13 |
| THR           | 0.11    | 0.12 | 0.02 | 0.08 | 0.12    | 0.11 | 0.01 | 0.08 |
| TSC           | 0.03    | 0.15 | 0.02 | 0.04 | 0.03    | 0.16 | 0.02 | 0.04 |
| Others        | 0.04    | 0.37 | 0.01 | 0.06 | 0.04    | 0.36 | 0.01 | 0.06 |
| <i>Female</i> |         |      |      |      |         |      |      |      |
| AGR           | 0.85    | 0.11 | 0.90 | 0.84 | 0.82    | 0.08 | 0.76 | 0.76 |
| MQ            | 0.00    | 0.00 | 0.01 | 0.00 | 0.00    | 0.00 | 0.01 | 0.00 |
| MANU          | 0.10    | 0.18 | 0.04 | 0.08 | 0.12    | 0.15 | 0.04 | 0.09 |
| EWU           | 0.00    | 0.00 | 0.00 | 0.00 | 0.00    | 0.01 | 0.00 | 0.00 |
| CTT           | 0.00    | 0.00 | 0.04 | 0.01 | 0.00    | 0.00 | 0.18 | 0.06 |
| THR           | 0.04    | 0.03 | 0.00 | 0.02 | 0.04    | 0.05 | 0.00 | 0.03 |
| TSC           | 0.00    | 0.02 | 0.00 | 0.00 | 0.00    | 0.01 | 0.00 | 0.00 |
| Others        | 0.02    | 0.65 | 0.01 | 0.04 | 0.02    | 0.69 | 0.01 | 0.05 |

Source calculated from 61st and 68th NSS unit record on EUS data



**Fig. 10.1** Change in share of rural male workers in the reform periods



**Fig. 10.2** Change in share of rural female workers in the reform periods

market. Classifications by activity type show that in the construction sector females have mostly joined as casual wage labourers and in other service as regular workers. Simultaneously, the share of male workers has increased in all the industries and decline in the agriculture sector with net male workers size has increased by around 18 million in the rural area.

Thus, non-farm diversification in the period between 2004–05 and 2011–12 has been mostly driven by the construction sector. Whereas in the earlier reform period, between 1993–94 and 2004–05, rise in non-farm employment has been driven by all the sectors of non-agricultural activity includes manufacturing, construction and services. Employment growth rate (usual status) by different industry groups for male and female workers separately is produced in Figs. 10.1 and 10.2. Against the period between 1993/94 and 2004/05, when rural services also generated employment opportunities, in the latter half of the 2000s, employment growth in services and manufacturing was almost negligible. Genderwise, as compared to male workers, there has been relatively higher growth of female workers in

manufacturing and services sectors in this period vis-à-vis the earlier period between 1993/94 and 2004/05. So, female workers, those who exited from the agricultural sector, have either left the labour market or moved to better jobs in manufacturing and services sectors, which has been clearly visible from industry-wise distribution of workers by employment quality (Table 10.2). In different employment status, share of self-employed workers has declined with commensurate increase in the wage worker including both regular and casual in the period between 2004/05 and 2011/12. In wage workers, the share of casual workers has increased manifold which is true for both male and female. Share of females in regular workers has been lower than the male counterpart but higher than the latter as self-employed worker.

Along with the decline in agriculture sector employment, the expansion of the non-farm employment and generation of mostly casual nature of job has been poverty reducing. Casual activities provide employment to unskilled workers who are mostly poor. However, employment in the construction sector that too as casual wage labourers is not much stable as the construction boom is highly volatile that impact casual labourer the most. Thus, for permanent income mobility nature of occupation must be improved as occupation and poverty are highly interlinked, which is discussed below.

### 10.3 Household Livelihood and Standard of Living

Historically, occupational pattern in India has been highly segregated on the basis of caste and gender which has generated deep divide into economic attainment of households belonging to different socio-economic groups. The strong association between caste, household livelihood and poverty incidence measured by HCR supports the argument, which is evident from cross-tabulation of HCR with economic and social groups for the latest NSS quinquennial 68th round (2011–12) presented in Table 10.3.

Poverty incidence has been relatively lower in non-farm as compared to farm sector, which is true for both casual and self-employment, and regular employment has undoubtedly lesser HCR. Among different occupational category, HCR is

**Table 10.3** Poverty incidence (HCR) and livelihood of the household: by social groups

| HH type/SGRP | ST   | SC   | OBC  | Others | All  |
|--------------|------|------|------|--------|------|
| SEA          | 42.2 | 28.9 | 20.3 | 13.4   | 22.2 |
| SENA         | 28.3 | 23.5 | 19.1 | 12.5   | 18.6 |
| REG          | 20.8 | 12.9 | 10.3 | 7.7    | 11.1 |
| CLAG         | 59.7 | 41.4 | 34.8 | 31.0   | 39.8 |
| CLNAG        | 54.5 | 32.7 | 29.7 | 23.0   | 32.7 |
| Others       | 44.3 | 27.6 | 16.5 | 8.2    | 17.8 |
| Total        | 45.3 | 31.5 | 22.7 | 15.5   | 25.4 |

*Sources:* Estimated from unit record NSS 68th rounds CES data using Tendulkar poverty line

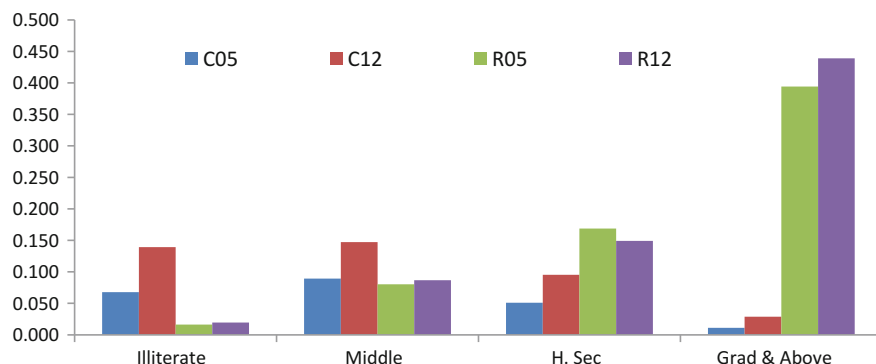
highest among casual agricultural labour (CLAG) household and lowest in regular salaried worker (REG) followed by self-employment in agriculture (SEA) and non-agriculture (SENA) sectors. Among different social groups, ST household has the highest level of HCR followed by SCs, OBCs and OSGs. Cross-tabulation of social and economic groups of the household shows the different levels of social stratification of the household across income levels. In fact, HCR in different economic groups varies significantly across social groups in rural area.

Aggregate HCR of REG households has been around 11%; however, even in the regular salaried households, ST household HCR is around 21%, followed by SCs with 13% and the OSG household has HCR of just 7% which is three times lower than ST household. Similarly, in CLAG household, HCR varies from around 60% in ST households' followed by 41% in SCs and around 31% in OSGs, which is just half of ST household. It implies that even similar nature of occupation has differential earnings, which is prevalent across social groups. Relatively better off household is in better earning occupation and industry and even the nature of employment is similar to the historically disadvantaged experienced by households. One of the explanations for this is the better social network of advantage social groups vis-à-vis disadvantage groups.

Thus, along with occupation, social status in the form of caste seems to be a crucial indicator of household standard of living. Caste has been sticky since social relations occur strictly within caste; however, occupational mobility can help in significant reduction of poverty. It is routed through occupational diversification from farm to non-farm sector. In this sense, labour market development with expansion of non-farm sector is expected to make significant dent on poverty. Channel through which non-farm sector can directly reduce poverty is productivity (per worker output) that has been relatively higher as compared to the agriculture sector (Tiwari 2016). At the same time, expansion of non-farm sector can indirectly reduce poverty by putting upward pressure on agriculture wages (Haggblade 2010). Agriculture wage and poverty incidence have been inversely and significantly correlated (Himanshu et al. 2013).

Along with the expansion of non-farm employment, other characteristics like nature and industry of occupation are crucial for realizing its larger impact. Since in the non-farm sector, there has been a huge gap in welfare between the households those working as casual wage labourers and regular salaried household, determinant of occupational nature becomes crucial. In this context out of many factors, as also postulated by human capital theorists, education is an important indicator.

Income and education are interlinked with two-way causation. Higher level of education is associated with higher probability of getting into better/highly paid occupation. At the same time, with improvement in income level and decline in share of expenditure on necessity items like food, investment on children's education increases. Further, with better education, prospects for higher income through better occupation goes up. Thus, it leads to a virtuous cycle and education is a prominent tool in occupational mobility. However, given the labour market imperfection like occupational segregation in developing country such as India, caste plays an important role. It is also argued by Kijima and Lanjouw (2005) and



**Fig. 10.3** Education and occupational choice (percentage of total working population) 2004–05 and 2011–12

Lanjouw and Murgai (2008) that impact of non-farm employment on poverty reduction and income mobility operates via caste affiliation and education level of individuals.

In Fig. 10.3, between two points of time 2004–05 and 2011–12, the share of casual workers has in fact increased more so in individuals with less than or equal to middle level of education. Furthermore, in regular employment, the share of those with education level graduates and above has increased. It means that the chance of moving to regular wage employment increases with the level of education particularly in individuals with higher than or equal to secondary level. Although education level of casual workers is also showing slight increase, this is actually the effect of overall increase in the level of education.

Caste and education as indicators of standard of living can be seen from probability of being in different income quintile given in Table 10.4. Average

**Table 10.4** Predicted probability of non-farm workers in different quintiles 2011–12

| Dependent/independent variables | Consumption quintiles (probability) |                |                |                |                |
|---------------------------------|-------------------------------------|----------------|----------------|----------------|----------------|
|                                 | Q <sub>1</sub>                      | Q <sub>2</sub> | Q <sub>3</sub> | Q <sub>4</sub> | Q <sub>5</sub> |
| <i>Education level</i>          |                                     |                |                |                |                |
| Illiterate                      | 42.5                                | 26.3           | 18.5           | 10.1           | 2.6            |
| Primary                         | 38.7                                | 25.5           | 22             | 10.5           | 3.4            |
| Middle                          | 38.1                                | 20.1           | 22.6           | 15.4           | 3.9            |
| Sec and H.Sec.                  | 29.4                                | 21.1           | 23.8           | 20.4           | 5.4            |
| Graduate and above              | 14.9                                | 24.6           | 24.8           | 24             | 11.7           |
| <i>Social status of workers</i> |                                     |                |                |                |                |
| ST                              | 55.0                                | 19.9           | 14.8           | 8.4            | 2.0            |
| SC                              | 39.9                                | 22.5           | 21.4           | 12.3           | 4.0            |
| OBC                             | 33.9                                | 25.7           | 21.4           | 14.6           | 4.5            |
| OSG                             | 27.1                                | 23.6           | 26             | 17.7           | 5.6            |
| ALL                             | 35.6                                | 23.7           | 21.9           | 14.3           | 4.4            |

probability of being in the bottom quintile is higher for illiterates, which declines with increase in educational level. Similarly, for caste, average probability is higher for STs and lowest for OSGs in the lower income quintile.

## 10.4 Employment Status and Income Level

The pattern of occupational structural transformation from farm to non-farm and its prospective impact on overall poverty reduction is analysed in the above section. Share of declining farm workers mostly got employed in the non-farm sector as casual workers in the construction sector. Now, with relatively higher productivity vis-à-vis agriculture, casual employment in the construction sector has been poverty reducing but analysis of its effect on permanent economic mobility is instructive as casual employment in construction sector is highly volatile. In this situation, poverty reduction due to casual employment in non-farm sector may be transient in nature. It has been argued (Kijima and Lanjouw 2005) that regular non-farm employment is most sought after in rural area as it is associated not only with high level of income but also with degree of stability. Although casual non-farm work may be considered less demeaning as compared to agricultural wage labourer, it is marginally productive and physically demanding as well as hazardous.

The occupational choice of an individual in economy is affected, at a point of time, by both supply and demand conditions prevailing in the labour market (Blau et al. 1956; Banerjee and Newman 1993). In this process, higher economic growth as mentioned in Piketty (2014) helps in intergenerational occupational mobility as it generates new employment opportunities. As the economic growth in India, in the period during 2004–05 and 2011–12, has been one of the highest with average growth of GDP around 8% per annum, it is expected that occupational mobility is to be smoother in this period. But economic growth alone cannot guarantee smooth upward mobility to all the sections of society and there are multiple factors at play in desired occupational transformation.

From the supply side, education has been an important factor that determines nature of employment an individual will end up in the labour market (Reddy 2015). Simultaneously, the quality of education, which is highly correlated with affordability, which can be seen in terms of different income quintile, plays a role in getting better employment opportunity. To see the impact of education, proportional share of non-farm employment and odds ratio<sup>3</sup> for different occupational status is calculated for the period 2004–05 and 2011–12 across income quintiles for workers in non-farm sector both at the aggregate level and at different levels of education in rural area, which is presented in Table 10.5.

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<sup>3</sup>Average odds ratio is calculated as the ratio of share of non-farm workers to total workers in income quintile to the average share of non-farm workers in total workers. It follows the method discussed in Kijima and Lanjouw (2005).

**Table 10.5** Percentage of working population in non-farm employment by quintiles

| Income quintiles | SE              | REG             | CAS             | SE              | REG             | CAS             |
|------------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
|                  | 2011–12         |                 |                 | 2004–05         |                 |                 |
| <i>All India</i> |                 |                 |                 |                 |                 |                 |
| Q1               | 0.145<br>(0.70) | 0.048<br>(0.27) | 0.176<br>(1.33) | 0.137<br>(0.68) | 0.071<br>(0.49) | 0.105<br>(1.21) |
| Q2               | 0.184<br>(0.88) | 0.087<br>(0.49) | 0.158<br>(1.19) | 0.178<br>(0.89) | 0.091<br>(0.62) | 0.106<br>(1.23) |
| Q3               | 0.208<br>(1.00) | 0.145<br>(0.81) | 0.138<br>(1.04) | 0.214<br>(1.06) | 0.146<br>(1.00) | 0.095<br>(1.10) |
| Q4               | 0.253<br>(1.21) | 0.247<br>(1.37) | 0.110<br>(0.83) | 0.245<br>(1.22) | 0.211<br>(1.44) | 0.066<br>(0.76) |
| Q5               | 0.287<br>(1.38) | 0.466<br>(2.59) | 0.054<br>(0.40) | 0.305<br>(1.52) | 0.318<br>(2.17) | 0.030<br>(0.35) |
| All              | 0.208<br>(1.00) | 0.180<br>(1.00) | 0.133<br>(1.00) | 0.201<br>(1.00) | 0.147<br>(1.00) | 0.086<br>(1.00) |
| <i>Rural</i>     |                 |                 |                 |                 |                 |                 |
| Q1               | 0.117<br>(0.84) | 0.035<br>(0.43) | 0.162<br>(1.21) | 0.114<br>(0.84) | 0.036<br>(0.58) | 0.084<br>(1.15) |
| Q2               | 0.139<br>(0.99) | 0.055<br>(0.69) | 0.144<br>(1.08) | 0.136<br>(1.00) | 0.049<br>(0.78) | 0.084<br>(1.15) |
| Q3               | 0.149<br>(1.06) | 0.084<br>(1.05) | 0.122<br>(0.91) | 0.152<br>(1.12) | 0.072<br>(1.14) | 0.073<br>(1.00) |
| Q4               | 0.164<br>(1.17) | 0.132<br>(1.65) | 0.107<br>(0.80) | 0.153<br>(1.12) | 0.097<br>(1.54) | 0.053<br>(0.72) |
| Q5               | 0.171<br>(1.22) | 0.233<br>(2.91) | 0.070<br>(0.53) | 0.161<br>(1.18) | 0.132<br>(2.11) | 0.030<br>(0.41) |
| All              | 0.141<br>(1.00) | 0.080<br>(1.00) | 0.134<br>(1.00) | 0.136<br>(1.00) | 0.063<br>(1.00) | 0.073<br>(1.00) |

At the aggregate level, individuals in regular non-farm employment occurred disproportionately in upper income quintile whereas in casual employment, participants are mostly from lower income quintile. Odds ratio is greater than one in regular non-farm employment in upper quintile and in casual non-farm employment odds ratio is more than one in bottom quintiles. Similar to regular non-farm employment, workers in self-employment are also slightly higher in upper quintile, although their share is more evenly distributed than regular non-farm employment. Odds ratio in upper quintile has been more than two while in self-employment it is more than one.

Between two survey periods, share in casual non-farm employment has increased in all the quintiles of consumption distribution, which is slightly higher in bottom quintile. In regular employment although average share has increased, this increase has been more frequently in top income quintiles with the declining share in bottom quintile.

Compared to all India pattern, in rural areas, distribution of workers in different consumption distribution quintile seems to be similar in regular and casual non-farm employment. However, in self-employment against the all India where individual has been slightly higher from upper quintile, it is more evenly distributed in rural area. In rural areas across income quintile, odds ratio of casual workers has been more than one in bottom income quintile. At the same time, it was higher than one for regular workers in upper income quintile and for self-employed, it is not much different across income quintile which is due to the mixed nature of self-employment. However, odds ratio for self-employed workers has been higher than casual workers in upper income quintile.

In the period between 2004–05 and 2011–12, odds ratio of getting regular employment increased at upper quintile and declined in lower quintile. Between the two years, average odds ratio of casual workers has increased across the income quintile, which supports the argument of increasing casualization of jobs in this period. Pattern of change between two surveys is similar to all India.

Occupational status has been disproportionately distributed across consumption distribution quintiles particularly for regular and casual non-farm employment. It is operative through educational status of the individual workers in the labour market which is clear from Table 10.6 in which proportional share of non-farm workers and odds ratio is presented with different education level.

**Table 10.6** Odds ratio of non-farm workers: by occupational status and income quintile

| Income quintiles  | SE              | REG             | CAS             | SE              | REG             | CAS             |
|-------------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
|                   | 2011–12         |                 |                 | 2004–05         |                 |                 |
| <i>Illiterate</i> |                 |                 |                 |                 |                 |                 |
| Q1                | 0.098<br>(1.00) | 0.012<br>(0.62) | 0.153<br>(1.10) | 0.092<br>(0.98) | 0.017<br>(1.01) | 0.074<br>(1.10) |
| Q2                | 0.101<br>(1.04) | 0.020<br>(1.00) | 0.156<br>(1.12) | 0.096<br>(1.02) | 0.014<br>(0.88) | 0.075<br>(1.10) |
| Q3                | 0.095<br>(0.97) | 0.027<br>(1.37) | 0.113<br>(0.81) | 0.107<br>(1.14) | 0.019<br>(1.14) | 0.065<br>(0.95) |
| Q4                | 0.093<br>(0.95) | 0.029<br>(1.50) | 0.113<br>(0.81) | 0.085<br>(0.90) | 0.016<br>(0.95) | 0.046<br>(0.67) |
| Q5                | 0.097<br>(0.99) | 0.027<br>(1.40) | 0.097<br>(0.69) | 0.073<br>(0.78) | 0.019<br>(1.15) | 0.024<br>(0.35) |
| All               | 0.098<br>(1.00) | 0.020<br>(1.00) | 0.139<br>(1.00) | 0.094<br>(1.00) | 0.016<br>(1.00) | 0.068<br>(1.00) |
| <i>Middle</i>     |                 |                 |                 |                 |                 |                 |
| Q1                | 0.130<br>(0.79) | 0.048<br>(0.55) | 0.188<br>(1.27) | 0.153<br>(0.88) | 0.070<br>(0.88) | 0.110<br>(1.23) |
| Q2                | 0.163<br>(0.98) | 0.079<br>(0.91) | 0.133<br>(0.90) | 0.178<br>(1.03) | 0.074<br>(0.93) | 0.095<br>(1.07) |

(continued)



**Table 10.6** (continued)

| Income quintiles          | SE              | REG             | CAS             | SE              | REG             | CAS             |
|---------------------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
|                           | 2011–12         |                 |                 | 2004–05         |                 |                 |
| Q3                        | 0.190<br>(1.15) | 0.100<br>(1.16) | 0.140<br>(0.95) | 0.183<br>(1.06) | 0.089<br>(1.11) | 0.093<br>(1.05) |
| Q4                        | 0.187<br>(1.13) | 0.113<br>(1.30) | 0.132<br>(0.90) | 0.184<br>(1.07) | 0.086<br>(1.07) | 0.072<br>(0.80) |
| Q5                        | 0.195<br>(1.18) | 0.166<br>(1.91) | 0.094<br>(0.64) | 0.164<br>(0.95) | 0.087<br>(1.08) | 0.055<br>(0.62) |
| All                       | 0.166<br>(1.00) | 0.087<br>(1.00) | 0.147<br>(1.00) | 0.173<br>(1.00) | 0.080<br>(1.00) | 0.089<br>(1.00) |
| <i>Sec. and H.Sec.</i>    |                 |                 |                 |                 |                 |                 |
| Q1                        | 0.149<br>(0.79) | 0.076<br>(0.51) | 0.128<br>(1.35) | 0.153<br>(0.79) | 0.138<br>(0.82) | 0.085<br>(1.67) |
| Q2                        | 0.182<br>(0.97) | 0.105<br>(0.70) | 0.108<br>(1.13) | 0.183<br>(0.95) | 0.15<br>(0.89)  | 0.071<br>(1.39) |
| Q3                        | 0.194<br>(1.03) | 0.143<br>(0.96) | 0.091<br>(0.95) | 0.203<br>(1.05) | 0.174<br>(1.03) | 0.049<br>(0.97) |
| Q4                        | 0.217<br>(1.15) | 0.195<br>(1.31) | 0.089<br>(0.93) | 0.207<br>(1.07) | 0.191<br>(1.13) | 0.037<br>(0.73) |
| Q5                        | 0.206<br>(1.09) | 0.270<br>(1.81) | 0.043<br>(0.45) | 0.214<br>(1.11) | 0.183<br>(1.08) | 0.018<br>(0.35) |
| All                       | 0.188<br>(1.00) | 0.149<br>(1.00) | 0.095<br>(1.00) | 0.193<br>(1.00) | 0.169<br>(1.00) | 0.051<br>(1.00) |
| <i>Graduate and above</i> |                 |                 |                 |                 |                 |                 |
| Q1                        | 0.181<br>(0.91) | 0.234<br>(0.53) | 0.038<br>(1.32) | 0.200<br>(0.91) | 0.268<br>(0.68) | 0.041<br>(3.70) |
| Q2                        | 0.184<br>(0.92) | 0.321<br>(0.73) | 0.059<br>(2.05) | 0.232<br>(1.05) | 0.295<br>(0.75) | 0.019<br>(1.74) |
| Q3                        | 0.196<br>(0.99) | 0.425<br>(0.97) | 0.032<br>(1.12) | 0.232<br>(1.05) | 0.383<br>(0.97) | 0.014<br>(1.26) |
| Q4                        | 0.209<br>(1.05) | 0.464<br>(1.06) | 0.022<br>(0.78) | 0.208<br>(0.94) | 0.417<br>(1.06) | 0.007<br>(0.66) |
| Q5                        | 0.206<br>(1.04) | 0.575<br>(1.31) | 0.013<br>(0.46) | 0.224<br>(1.02) | 0.456<br>(1.16) | 0.001<br>(0.11) |
| All                       | 0.199<br>(1.00) | 0.439<br>(1.00) | 0.029<br>(1.00) | 0.220<br>(1.00) | 0.394<br>(1.00) | 0.011<br>(1.00) |

Share of regular non-farm employment increases with the level of education while that of casual non-farm employment declines. Proportional share of regular non-farm employment has been much less in illiterates and increases with education. Against this, casual non-farm employment share is higher in illiterate, which declines with the level of education. In 2011–12, whereas around 14% of illiterate workers are in casual employment, this has been only 3% in graduate and above

workers. On the contrary, whereas 2% of illiterate workers are in regular non-farm employment, this proportion is 44% in graduate and above workers.

Illiterate workers are evenly distributed across the quintiles of consumption distribution in self-employed and regular non-farm employment. But in casual non-farm employment, the distribution has been more frequently in lower income quintile and odds ratio is more than one in bottom quintiles that declines in upper quintile. Regular employment distribution across quintile has been even for illiterate but in graduate and above, the regular non-farm employment occurred disproportionately in the upper consumption quintile.

The proportional share of self-employed non-farm employment has been almost the same across the education level. Overall trend for self-employed employed, at every level of education, has been of even distribution across quintiles of consumption distribution with slightly higher frequency in upper quintile and the only exception are illiterate workers.

The pattern remained similar in the period during 2004–05 and 2011–12. Self-employed non-farm employment share remained intact in illiterate and declined with increase in education level during this period. Share of workers from lower quintile has increased in casual employment and decreased in regular employment. Increase in share of casual worker has been higher in bottom quintile. Further, the change in regular employment has been negligible up to higher secondary level and increased only in those with education level of graduates and above.

## **10.5 Probability of Being in Different Occupations: Multinomial Results**

Multinomial model of access to different occupation is fitted and estimated through maximum likelihood method of estimation. The model is estimated by controlling for place of residence, gender, income level, education level, etc., and the results of the model for three points of time (1993–94, 2004–05 and 2011–12) are given in appendix tables. Here, below in tables average predicted probabilities for different covariates when other variables are at national mean is calculated and is reported.

Mean predicted probability of getting into occupational status of non-farm employment has increased over the past two decades in the reform period (Table 10.7). Predicted probability of access to farm employment has declined in both self-employment and wage employment. Social status remained a crucial determinant of access to occupation, which seems to be sticky. Over the period probability of SC in occupation as agricultural labour has declined with subsequent increase in non-farm casual labour. Non-farm employment probability is higher for OSGs in self-employment and regular employment. Muslims' probability of access to self-employment in non-farm has been higher than non-Muslims (Table 10.8).

Education has been crucial in getting regular employment in non-farm sector as can be seen from rise in probability with the level of education. Over the period in

**Table 10.7** Predicted probabilities of access to occupation in rural area

|                | Cultivator | Farm regular | Farm labour | Non-farm self-employed | Non-farm regular | Non-farm casual |
|----------------|------------|--------------|-------------|------------------------|------------------|-----------------|
| <i>1993–94</i> |            |              |             |                        |                  |                 |
| ST             | 62.1       | 1.1          | 21.6        | 4.8                    | 5.1              | 5.3             |
| SC             | 35.6       | 1.6          | 41.6        | 9.4                    | 3.9              | 7.9             |
| OSG            | 59.8       | 1.2          | 14.6        | 12.6                   | 7.2              | 4.6             |
| Non-Muslims    | 57.8       | 1.3          | 19.3        | 10.2                   | 6.7              | 4.7             |
| Muslims        | 47.4       | 1.1          | 18.8        | 19.5                   | 5.1              | 8.2             |
| Total          | 56.6       | 1.3          | 19.2        | 11.3                   | 6.5              | 5.1             |
| <i>2004–05</i> |            |              |             |                        |                  |                 |
| STs            | 62.8       | 0.7          | 13.6        | 8.5                    | 7.9              | 6.4             |
| SCs            | 34.4       | 0.5          | 29.8        | 14.9                   | 6.8              | 13.5            |
| OSGs           | 52.7       | 0.6          | 12.5        | 19.1                   | 8.1              | 6.9             |
| Non-Muslim     | 52.2       | 0.7          | 15.8        | 15.6                   | 8.1              | 7.6             |
| Muslims        | 43.5       | 0.4          | 13.6        | 26.2                   | 6.3              | 10.0            |
| ALL            | 51.1       | 0.6          | 15.5        | 17.0                   | 7.9              | 7.9             |
| <i>2011–12</i> |            |              |             |                        |                  |                 |
| STs            | 50.3       | 0.4          | 9.8         | 13.0                   | 11.5             | 15.0            |
| SCs            | 27.8       | 0.3          | 21.6        | 15.3                   | 9.8              | 25.2            |
| OSGs           | 43.0       | 0.4          | 10.5        | 20.9                   | 11.6             | 13.6            |
| Non-Muslim     | 43.0       | 0.4          | 12.5        | 17.6                   | 11.6             | 14.9            |
| Muslims        | 34.2       | 0.3          | 9.8         | 26.8                   | 9.5              | 19.4            |
| ALL            | 41.7       | 0.4          | 12.1        | 18.9                   | 11.3             | 15.6            |

**Table 10.8** Predicted probabilities of access to occupation in rural area

|                    | Cultivator | Farm regular | Farm labour | Non-farm self-employed | Non-farm regular | Non-farm casual |
|--------------------|------------|--------------|-------------|------------------------|------------------|-----------------|
| <i>1993–94</i>     |            |              |             |                        |                  |                 |
| Illiterate         | 57.8       | 1.7          | 28.0        | 6.9                    | 0.9              | 4.7             |
| Up to primary      | 59.3       | 1.1          | 17.4        | 12.9                   | 2.4              | 6.8             |
| Middle             | 58.4       | 0.7          | 11.3        | 16.3                   | 7.5              | 5.9             |
| Sec and H.Sec.     | 51.0       | 0.7          | 5.1         | 17.3                   | 22.7             | 3.2             |
| Graduate and above | 32.5       | 0.6          | 1.3         | 14.9                   | 50.1             | 0.7             |
| Total              | 56.6       | 1.3          | 19.2        | 11.3                   | 6.5              | 5.1             |
| <i>2004–05</i>     |            |              |             |                        |                  |                 |
| Illiterate         | 55.1       | 0.7          | 23.8        | 11.5                   | 1.4              | 7.6             |
| Primary            | 52.2       | 0.7          | 16.1        | 17.5                   | 3.3              | 10.2            |

(continued)

**Table 10.8** (continued)

|                    | Cultivator | Farm regular | Farm labour | Non-farm self-employed | Non-farm regular | Non-farm casual |
|--------------------|------------|--------------|-------------|------------------------|------------------|-----------------|
| Middle             | 51.1       | 0.4          | 9.9         | 21.4                   | 8.3              | 8.9             |
| Sec and H.Sec.     | 47.8       | 0.6          | 4.2         | 22.9                   | 19.9             | 4.6             |
| Graduate and above | 28.6       | 0.8          | 0.8         | 21.8                   | 47.2             | 0.8             |
| Total              | 51.1       | 0.6          | 15.5        | 17.0                   | 7.9              | 7.9             |
| <i>2011–12</i>     |            |              |             |                        |                  |                 |
| Illiterate         | 48.3       | 0.3          | 20.1        | 12.1                   | 2.0              | 17.2            |
| Primary            | 42.5       | 0.3          | 15.0        | 18.0                   | 3.8              | 20.3            |
| Middle             | 40.9       | 0.4          | 8.7         | 23.6                   | 9.0              | 17.4            |
| Sec and H.Sec.     | 40.6       | 0.4          | 4.7         | 25.0                   | 19.2             | 10.2            |
| Graduate and above | 23.2       | 0.5          | 0.7         | 20.5                   | 52.7             | 2.4             |
| Total              | 41.7       | 0.4          | 12.1        | 18.9                   | 11.3             | 15.6            |

reform era, probability has declined in farm sector and increases in the non-farm sector. Increase in the probability of self-employed in non-farm has increased sharply in the period between 1993–94 and 2004–05, while it has declined in regular non-farm employed for graduates and above. Further, in the period between 2004–05 and 2011–12, in non-farm employment, probability of getting access into casual labour has increased sharply much for those with education level up to middle. In the former subperiod, getting access to self-employed in non-farm sector shows lack of opportunities; this phenomenon is described as distress driven (Abraham 2009). Further in the later period since 2004–05, increased probability in casual non-farm employment has been a signal of exploitative condition in the labour market. Education is an important determinant in getting access to most sought after regular non-farm employment as predictive probability increases with the level of education. However, the most effective is education level higher secondary and above, given huge gap in probability.

## 10.6 Concluding Observations

Structural transformation and movement of workers to productive sector is crucial indicator of economic development. After decade of stagnation, Indian economy experienced off-farm occupational transformation in the reform period which is faster in the period during 2004–05 and 2011–12; however, in rural area still around 65% of population depend on agriculture for livelihood. In rural labour market, in this period, two important determinants of non-farm employment were construction

sector and public employment programme MGNREGA. Non-farm employment has been indirectly poverty reducing through upward pressure on agricultural wages (Kijima and Lanjouw 2005) and directly it can be effective if nature of employment is regular given its stability and higher earnings. But in this period, non-farm employment generated has been mostly casual in nature, which creates doubts on permanent economic mobility.

Occupational status in non-farm sector is intrinsically linked with economic mobility which is clearly evident through odds ratio analysis. It is more than one in bottom quintiles for casual non-farm employment and more than one in top quintile for regular non-farm employment. Those individuals engaged in casual employment in this period are frequently from lower income quintile. Odds ratio for self-employment shows its mixed nature as employees in it are frequently from across the income quintile. Multinomial model of access to different occupation in rural area for three points of time in the reform period shows dominant role of caste and education. Since caste is sticky in nature, human capital formation through better and quality education is important for economic mobility without which casualization of employment will not provide desired outcome.

**Acknowledgements** We are grateful to the participants of seminar at CSRD, JNU, held on 12–13 March 2016.

## Appendix

See Tables 10.9, 10.10 and 10.11.

**Table 10.9** Multinomial results of occupational access in rural India, 1993–94

|                        | Farm regular    | Farm labour     | Non-farm self-employed | Non-farm regular | Non-farm casual |
|------------------------|-----------------|-----------------|------------------------|------------------|-----------------|
| Age                    | 0.146 (6.66)    | 0.009 (2.11)    | 0.069 (20.38)          | 0.160 (31.11)    | 0.043 (10.83)   |
| Age squared            | −0.002 (−6.93)  | −0.000 (−8.48)  | −0.001 (−22.05)        | −0.002 (−30.95)  | −0.001 (−18.6)  |
| Up to primary          | 0.248 (2.02)    | −0.338 (−12.57) | 0.555 (22.94)          | 0.962 (22.36)    | 0.083 (3.35)    |
| Middle                 | 0.143 (1.03)    | −0.835 (−24.74) | 0.658 (25.19)          | 1.503 (35.08)    | −0.111 (−3.95)  |
| Sec and H. Sec.        | 0.201 (1.5)     | −1.450 (−36.9)  | 0.704 (27.76)          | 2.258 (56.83)    | −0.624 (−20.34) |
| Graduate and above     | 0.760 (4.11)    | −2.612 (−19.04) | 1.018 (26.19)          | 3.717 (81.82)    | −1.389 (−17.53) |
| SC                     | 0.467 (3.09)    | 1.399 (39.33)   | 0.887 (28.27)          | 0.667 (18.34)    | 1.200 (39.02)   |
| OSG                    | 0.044 (0.38)    | 0.343 (10.98)   | 0.506 (21.17)          | −0.160 (−5.87)   | 0.065 (2.51)    |
| Muslims                | 0.384 (2.51)    | 0.162 (4.00)    | 0.898 (34.48)          | 0.807 (22.66)    | 0.775 (24.96)   |
| Household size         | −0.150 (−7.53)  | −0.197 (−38.77) | −0.108 (−33.31)        | −0.166 (−37.37)  | −0.155 (−37.16) |
| Constant               | −6.533 (−13.88) | 0.056 (0.60)    | −2.299 (−30.14)        | −4.934 (−43.94)  | −0.526 (−6.23)  |
| Number of observations | 110,669         |                 |                        |                  |                 |
| Log likelihood         | −149019         |                 |                        |                  |                 |
| Pseudo-R2              | 0.106           |                 |                        |                  |                 |

**Table 10.10** Multinomial results of occupational access in rural India, 2004–05

|                        | Farm regular    | Farm labour     | Non-farm self-employed | Non-farm regular | Non-farm casual |
|------------------------|-----------------|-----------------|------------------------|------------------|-----------------|
| Age                    | 0.079 (6.81)    | 0.027 (9.58)    | 0.057 (21.85)          | 0.171 (38.44)    | 0.040 (9.78)    |
| Age squared            | −0.001 (−7.92)  | −0.001 (−19.66) | −0.001 (−24.82)        | −0.002 (−35.9)   | −0.001 (−18.15) |
| Up to primary          | 0.060 (0.89)    | −0.477 (−26.52) | 0.449 (24.93)          | 1.142 (32.24)    | 0.153 (6.37)    |
| Middle                 | −0.644 (−6.39)  | −0.979 (−39.47) | 0.534 (25.81)          | 1.821 (50.64)    | 0.000 (0)       |
| Sec and H. Sec.        | −0.343 (−3.49)  | −1.741 (−47.27) | 0.647 (29.79)          | 2.741 (80.67)    | −0.566 (−14.83) |
| Graduate and above     | 0.494 (3.62)    | −2.781 (−20.6)  | 1.072 (29.81)          | 3.953 (97.5)     | −1.660 (−12.24) |
| SC                     | 0.372 (3.82)    | 1.417 (59.58)   | 1.264 (46.44)          | 0.658 (20.15)    | 1.437 (44.64)   |
| OSG                    | 0.162 (2.21)    | 0.211 (10.07)   | 0.845 (37.8)           | −0.199 (−7.87)   | 0.260 (8.92)    |
| Muslims                | −0.260 (−2.09)  | 0.283 (9.83)    | 0.860 (39.8)           | 0.695 (20.25)    | 0.718 (21.53)   |
| Household size         | −0.098 (−9.19)  | −0.188 (−58.15) | −0.089 (−37.17)        | −0.136 (−38.3)   | −0.149 (−36.47) |
| Constant               | −4.777 (−20.07) | −0.083 (−1.43)  | −2.581 (−45.77)        | −5.885 (−62.2)   | −1.558 (−19.7)  |
| Number of observations | 168,736         |                 |                        |                  |                 |
| Log likelihood         | −207591         |                 |                        |                  |                 |
| Pseudo-R2              | 0.114           |                 |                        |                  |                 |

**Table 10.11** Multinomial results of occupational access in rural India, 2011–12

|                        | Farm regular    | Farm labour     | Non-farm self-employed | Non-farm regular | Non-farm casual |
|------------------------|-----------------|-----------------|------------------------|------------------|-----------------|
| Age                    | 0.006 (0.74)    | 0.055 (22.68)   | 0.042 (14.15)          | 0.198 (36.05)    | 0.052 (11.16)   |
| Age squared            | 0.000 (−3.84)   | −0.001 (−30.72) | −0.001 (−15.01)        | −0.002 (−33.03)  | −0.001 (−16.69) |
| Up to primary          | −0.537 (−8.52)  | −0.523 (−31.32) | 0.610 (28.43)          | 1.135 (28.86)    | 0.268 (9.6)     |
| Middle                 | −1.055 (−10.07) | −1.055 (−39.12) | 0.765 (28.93)          | 1.963 (47.89)    | 0.056 (1.43)    |
| Sec and H.Sec.         | −0.901 (−7.94)  | −1.703 (−41.93) | 0.942 (33.49)          | 3.116 (83.1)     | −0.390 (−7.3)   |
| Graduate and above     | −0.491 (−2.2)   | −2.647 (−17.36) | 1.201 (22.82)          | 4.100 (84.38)    | −1.403 (−6.9)   |
| SC                     | 0.959 (10.71)   | 1.246 (56.16)   | 1.349 (34.21)          | 0.570 (12.41)    | 1.042 (26.11)   |
| OSG                    | 0.321 (4.15)    | −0.211 (−11.09) | 0.797 (23.5)           | −0.215 (−5.95)   | −0.157 (−4.42)  |
| Muslims                | 0.092 (0.84)    | 0.521 (18.4)    | 1.061 (37.7)           | 0.726 (15.98)    | 1.040 (25.17)   |
| Household size         | −0.117 (−11.81) | −0.201 (−68.49) | −0.066 (−22.79)        | −0.105 (−26.08)  | −0.159 (−31.32) |
| Constant               | −2.900 (−17.02) | −0.071 (−1.47)  | −3.158 (−47.55)        | −6.752 (−59.71)  | −1.979 (−22.43) |
| Number of observations | 153,710         |                 |                        |                  |                 |
| Log likelihood         | −174107         |                 |                        |                  |                 |
| Pseudo-R2              | 0.125           |                 |                        |                  |                 |

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# Chapter 11

## Shortages in Agriculture Labour Market and Changes in Cropping Pattern

Sarda Prasad

### 11.1 Introduction

Indian rural labour market is flexible and seasonal and is affected by multiple factors. These include social economic and demographic factors such as capital, production technology led by high-yielding varieties and mechanization, land utilization, fertility, migration, climate change and industrialization. Among these factors, migration, according to the Food and Agriculture Organization (FAO), affects supply and demand of farm labour which in turn influences cropping pattern. The International Fund for Agriculture Development (IFAD 2011) maintained that changes in agricultural sector occur due to globalization, liberalization and privatization worldwide that have led rural to urban migration. Globalization is fundamentally changing the nature of our everyday experiences and societies in which we live and the way we connect with others. Globalization-led economic growth has brought structural changes in the job/labour market in both rural and urban areas. There has been a shift in labour market from agriculture to other high value-added manufacturing and service sectors in search of better and regular jobs with higher wage rates. An increased migration from rural to urban areas, growing literacy rate, widening wage gaps in agriculture and non-agriculture sectors has resulted in a decline in the labour force in agriculture. Concomitantly, growing per capita incomes and urbanization and changing lifestyles in urban areas have changed the consumption pattern towards fruits-vegetables, processed food, milk and milk products, meat and meat products, etc.

To meet the demands of urban residents, cropping patterns have been changing but food growers are declining because of a movement of agricultural labours and cultivators towards industry and non-farm sectors. According to Census of India (2011), population is increasing at a decreasing rate and work participation rate of

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cultivators has decreased by 18.4% in which female cultivators declined by 20% and male cultivators declined by 17.5% from 2001 to 2011. Operational landholdings are also decreasing due to urbanization and population growth. The average operational landholdings are now 1.10 ha per person, which is a matter of concern.

Several challenges emerge for farmers and agricultural scientists such as sufficient and quality food, short duration high-yielding varieties (HYVs), low labour-intensive crops and production technologies due to labour shortage; post-harvest management techniques owing to changing food habits and need to reduce post-harvest losses; processed foods and its supply chain management. Changes in agriculture labour market either in numerical or structural terms affect quality and quantity of growth in agriculture. Labour shortage is one of the main hindrances in the production of quality food with sufficient quantity and diverse cropping patterns. One of the reasons for crop diversification from cereals to horticulture has not scaled up in Punjab is the low supply of farm labour. Cropping patterns remain the same due to labour shortages and increased mechanization. Farmers either stop growing labour-intensive crops (paddy, wheat and vegetables) or adopt low labour-intensive crops such as pulses (Prabakar et al. 2011; Prasad 2015).

In this background, this chapter aims to study the trends and patterns in agriculture labour market, the factors that have influenced it and the relationship between agricultural labour and cropping patterns by taking a case study of Bundelkhand region in Uttar Pradesh. The analysis is based on both primary and secondary data. The study is structured into five sections. Section 2 presents database and methodology. Section 3 analysis trends and patterns in rural labour markets in UP. Section 4 highlights the main factors behind the emerging labour market shortages and their impact on cropping pattern in the region. The last section draws main findings.

## 11.2 Database and Methodology

Both primary and secondary data have been used to work the objectives. Primary data have been collected through structured interview schedule as well as focus group discussion from six villages in two districts of Bundelkhand region of Uttar Pradesh. Villages have been selected based on distance from main town such as nearest (first village), nearer (second village in line) and distant villages (more than 20 km). Total 180 farmers were interviewed from each migrant (MH) and non-migrant households (NMH) in equal proportion (120 households) of each category of the farmers, that is, marginal and small farmers (less than one hectare and up to two hectares), medium farmer (having operated area between 2 and 6 ha) and large farmer (having land 6 ha and above). In all, 360 households were selected

for the purpose randomly from list of the landlords obtained from Lekhpal. The secondary sources of data include the NSSO, NFHS, CSO and agriculture census. The methodology used is univariate, bivariate and multivariate analyses. Demographic changes and their rates have been measured to know the status of working and non-working-age population in rural areas.

### 11.3 Trends and Patterns in Agriculture Labour Market

There are two main active agents of food production: cultivator and agricultural labour. According to Census of India, *Cultivator* is a person if he or she is engaged in cultivation of land owned or held from government or held from private persons or institutions for payment in money, kind or share. Cultivation involves ploughing, sowing, harvesting and production of cereals and millet crops and other crops such as sugarcane, tobacco, groundnuts, tapioca, and pulses, raw jute and fibre crop, cotton, cinchona and other medicinal plants, fruit growing, vegetable growing or keeping orchards or groves, etc. Cultivation does not include plantation crops, viz. tea, coffee, rubber, coconut and betel nuts (areca). *Agricultural labourer* is a person who works on another person's land for wages in money or kind or share. She or he has no risk in the cultivation but merely works on another person's land for wages. An agricultural labourer has no right of lease or contract on land on which she/he works. National Commission on Labour defined "an agricultural labourer is one who is basically unskilled and unorganized and has little for its livelihood, other than personal labour."

Butola (2016) mentioned the forms of labour in rural India such as community labour, slave and bonded labour, serf, family labour, wage labour, labour in the cooperative agricultural and state farms and virtual labour. The rural labour market is clique here, and it consists of agriculture labour and non-agriculture labour. Farm labour is classified into: unpaid labour or family labour and farmer own (fixed input) and paid labour (skilled and unskilled). Paid labours are permanent or attached labour (fixed input) and casual-hired labour or seasonal labour (variable input). Casual labour is hired according to the demand for agricultural operations, being seasonal only. Agriculture labour market changes according to supply, demand and wage rate during the field operations. Raju and Rao (2002) mentioned that hiring of casual agriculture labour depends upon a factor—why is this field operation necessary (i.e. demand of labour)?; where should it be done (type of crop or field operation)?; when should it be done (time of work for labour)?; who should do it (skilled or unskilled labour)?; and what is the best way to do it (human or machine labour)? Supply and demand of agriculture labour is determined by labour: *Availability* (no scarcity), *Accessibility* (no shortage) and *Affordability* (low wage rate).

### 11.3.1 Availability of Labour for Agriculture Work

Availability of labour in any geographic region/area depends upon demographic patterns (fertility, mortality and migration) during a particular period. All these three pillars of demography affect labour market either by population growth or reduction by biological processes (fertility and mortality), socio-economic (migration, literacy, interest of labour to work, wage rate, etc.) and political process (policies, and government welfare and employment schemes). Population growth indicates declining trends in both rural and urban areas. The population is increasing with decreasing rate of growth in major states, even total fertility rate (TFR) is declining over period of time (Fig. 11.1). TFR of urban areas has reached at replacement level (2.1) in 2004, and after 2004 TFR is below replacement level. In contrast to low TFR of urban areas, population is increasing faster rate. Figure 11.2 clearly shows rural to urban migration by age and sex in 2001 and 2011 Census of India that led shortage of working-age population in rural areas that is main input in agriculture. Age–sex population pyramid shows that age group of 15–59 year has shifted to urban areas from 2001 to 2011 that led transfer of labour from agriculture to non-agriculture sector, resulting in labour shortage in agriculture.

The annual population growth rate has been declining in both rural and urban India. The highest annual growth rate at 5% was recorded in Nagaland from 1991 to 2001. On one hand, fertility is declining in rural areas and literacy rate increasing that may have led rural to urban migration. Table 11.1 shows that rural areas are the highest producers of migrants in all the major states, and Uttar Pradesh (UP) is placed in the first rank. Census of India 2001 also found that the rural to urban

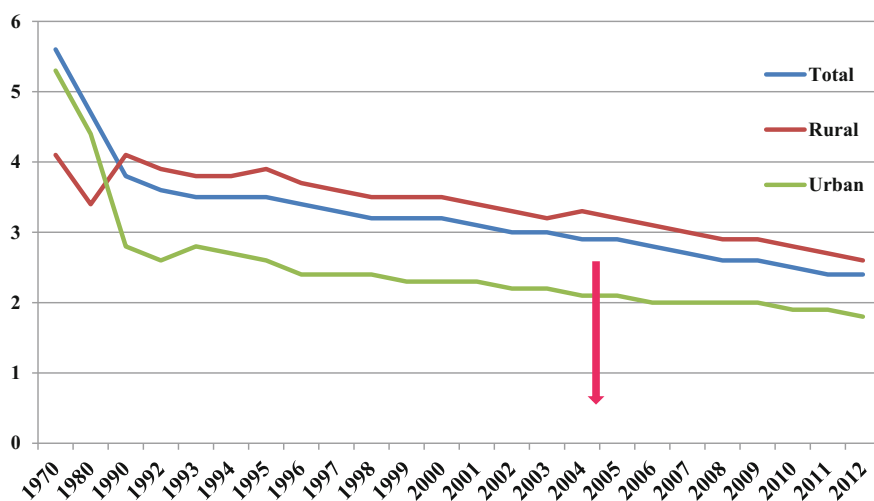


Fig. 11.1 Total fertility

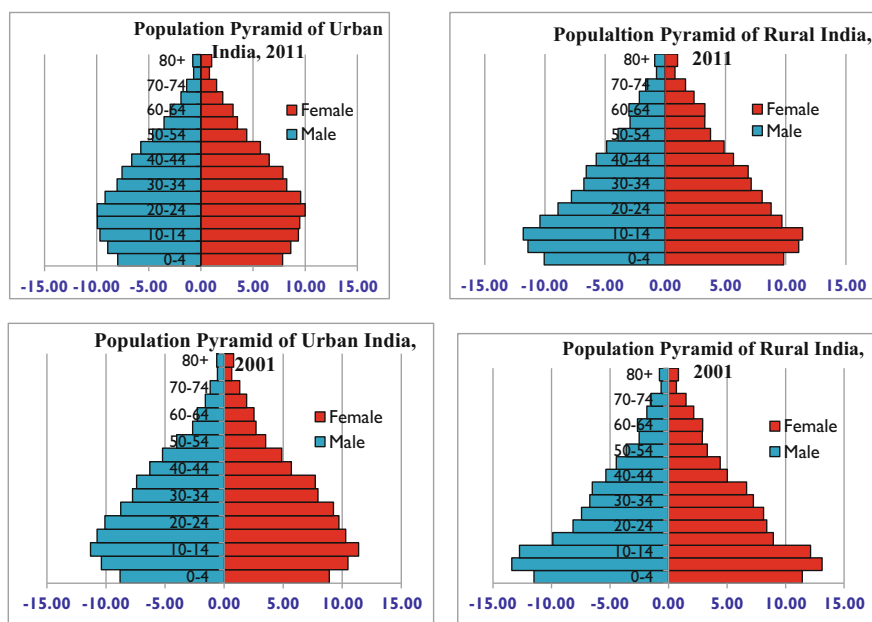


Fig. 11.2 Age-sex population pyramid by residence in 2001 and 2011

**Table 11.1** Top 10 states of India by total out-migrants and residence from 2007 to 2008

| Rank | State          | Rural |         | Urban |         | Total |           |
|------|----------------|-------|---------|-------|---------|-------|-----------|
|      |                | %     | Number  | %     | Number  | %     | Number    |
| 1    | Uttar Pradesh  | 15.0  | 821,986 | 10.5  | 222,877 | 13.7  | 1,044,863 |
| 2    | Madhya Pradesh | 13.4  | 735,666 | 6.2   | 131,090 | 11.4  | 866,756   |
| 3    | Maharashtra    | 7.6   | 417,016 | 17.1  | 364,226 | 10.3  | 781,242   |
| 4    | Andhra Pradesh | 8.4   | 462,937 | 14.9  | 316,770 | 10.2  | 779,707   |
| 5    | Bihar          | 9.8   | 535,537 | 1.9   | 40,368  | 7.6   | 575,905   |
| 6    | Tamil Nadu     | 3.9   | 213,180 | 15.7  | 333,255 | 7.2   | 546,435   |
| 7    | West Bengal    | 8.3   | 452,879 | 1.7   | 37,164  | 6.4   | 490,043   |
| 8    | Gujarat        | 6.6   | 362,740 | 5.5   | 117,033 | 6.3   | 479,773   |
| 9    | Kerala         | 4.6   | 252,734 | 6.0   | 126,909 | 5.0   | 379,643   |
| 10   | Karnataka      | 3.3   | 182,259 | 6.6   | 140,374 | 4.2   | 322,633   |

Source NSSO (2010)

migration rate is higher for working-age male and rural to rural migration rate is higher for female working-age population. It may be because of socio-economic processes. Thus, availability of labour in rural areas is determined by demographic and socio-economic process by shifting of labour from rural areas to other areas (either rural or urban).

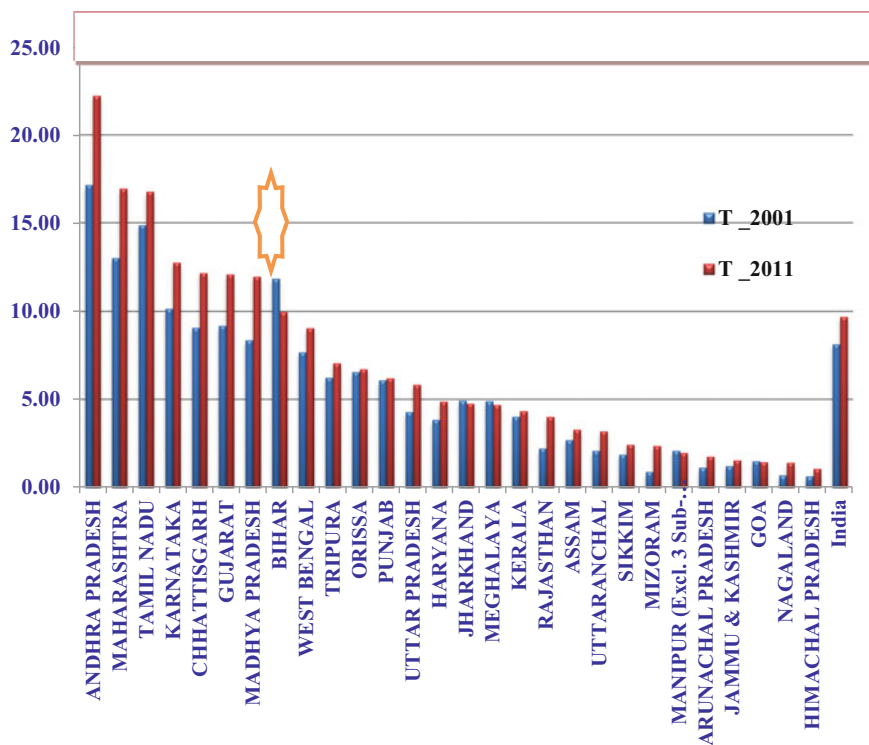
In the study area, the availability of agriculture labour to the farmer was higher in villages located nearer the main town and lowest in the distant villages. It has been observed that labours from nearest village were commuting and labour from distant villages opted to migrate to another city/state. This was perhaps the main reason behind agriculture labour shortage in these villages (Table 11.2).

Across states, main agriculture work participation rate has increased from 2001 to 2011, except in Bihar and Jharkhand that show the result of rural out-migration (Fig. 11.3). Total workers along with main workers have reduced in rural areas. During a decade, 18% of agriculture work involvement rate has increased and at the same time almost similar percentage of cultivators has declined (Table 11.3). In UP, the number of cultivators have decreased more as compared to the number of agriculture labours have increased in the same period of time. There are two main hunches of increasing agriculture work participation rate and decreasing cultivator in rural India. Firstly, operational landholding decreases as result of population growth and land is not sufficient for cultivation; cultivator (basically farmer) converted into agriculture labour or they have opted to leasing out of land and to migrate. Secondly, agriculture is facing many risks such as drought, frost, insect pest management, hail storm and theft; the wage rate in rural areas either in

**Table 11.2** Odds ratio for labour availability in the village

| Item | Exp(B)                                        | Sig.  |
|------|-----------------------------------------------|-------|
| 1    | <i>Distance of the village from main city</i> |       |
|      | Nearest (<10 km) <sup>®</sup>                 | –     |
|      | Nearer (10–15 km)                             | 1.417 |
|      | Distant (>15 km)                              | 0.365 |
| 2    | <i>Caste</i>                                  |       |
|      | Schedule caste <sup>®</sup>                   | –     |
|      | Other backward castes                         | 0.884 |
|      | General                                       | 0.901 |
| 3    | <i>Type farmers</i>                           |       |
|      | Marginal and small farmer <sup>®</sup>        | –     |
|      | Medium farmer                                 | 0.878 |
|      | Large farmer                                  | 2.058 |
| 4    | <i>Type of family</i>                         |       |
|      | Single <sup>®</sup>                           | –     |
|      | Joint                                         | 3.483 |
| 5    | <i>Source of irrigation</i>                   |       |
|      | Own                                           |       |
|      | Hired                                         | 1.744 |
| 6    | <i>Household</i>                              |       |
|      | NMHs                                          | –     |
|      | MHs                                           | 1.754 |
|      | Constant                                      | 0.39  |

Source Primary Survey (2011)



**Fig. 11.3** Main agriculture work participation rate (%) 2001 and 2011 (T-total). *Source* Registrar General, India (2001a, 2011)

MGNREGA work or others work was higher than agricultural income from land-holding without any risk. In rural areas, MNREGA wage rate has become the base. As farmers cannot pay on the spot to the labour, their bargaining power has increased and farmers seem helpless in this condition and were unable to access required number of labour.

### 11.3.2 Accessibility of Labour for Agriculture Work

The availability of labour for agricultural work is determined by demographic and socio-economic processes. In case, labour is available (no scarcity of labour) in rural areas, but they are not accessible to the farmer that is considered as labour shortage in agriculture. Accessibility of labour depends upon the socio-economic status of the farmer/landlord. If farmer is from non-SC/ST household, they can easily access labour for agriculture work during peak periods (Table 11.2). It may be because labour has expectation for more number of day's jobs from large farmer and payment of wages on time. In our survey, farmers were asked how many

**Table 11.3** Work participation rate (%) by sex and residences in India

| Item                | Rural |      |          | Urban |      |          |
|---------------------|-------|------|----------|-------|------|----------|
|                     | 2001  | 2011 | % Change | 2001  | 2011 | % Change |
| <i>Female</i>       |       |      |          |       |      |          |
| Total worker        | 30.8  | 30.0 | −2.6     | 11.9  | 15.4 | 29.4     |
| Main worker         | 16.6  | 16.7 | 0.6      | 9.4   | 11.9 | 26.6     |
| Cultivator          | 6.9   | 5.5  | −20.3    | 0.3   | 0.3  | 0.0      |
| Agricultural labour | 5.9   | 7.2  | 22.0     | 0.7   | 0.9  | 28.6     |
| Household worker    | 0.9   | 0.8  | −11.1    | 1.0   | 0.9  | −10.0    |
| Other worker        | 2.9   | 3.2  | 10.3     | 7.3   | 9.8  | 34.2     |
| <i>Male</i>         |       |      |          |       |      |          |
| Total worker        | 52.1  | 53.0 | 1.7      | 50.6  | 53.8 | 6.3      |
| Main Worker         | 44.3  | 41.6 | −6.1     | 47.2  | 48.7 | 3.2      |
| Cultivator          | 20.0  | 16.5 | −17.5    | 1.2   | 1.3  | 8.3      |
| Agricultural labour | 10.3  | 12.1 | 17.5     | 1.3   | 1.8  | 38.5     |
| Household worker    | 1.3   | 1.0  | −23.1    | 1.6   | 1.7  | 6.2      |
| Other worker        | 12.7  | 12.1 | −4.7     | 43.0  | 43.8 | 1.9      |
| <i>Total</i>        |       |      |          |       |      |          |
| Total worker        | 41.7  | 41.8 | 0.2      | 32.3  | 35.3 | 9.3      |
| Main Worker         | 30.9  | 29.5 | −4.5     | 29.3  | 30.9 | 5.5      |
| Cultivator          | 13.6  | 11.1 | −18.4    | 0.8   | 0.8  | 0.0      |
| Agricultural labour | 8.2   | 9.7  | 18.3     | 1.0   | 1.4  | 40.0     |
| Household worker    | 1.1   | 0.9  | −18.2    | 1.4   | 1.3  | −7.1     |
| Other worker        | 7.9   | 7.8  | −1.3     | 26.1  | 27.4 | 5.0      |

Source Registrar General, India (2001a, 2001b, 2011)

**Table 11.4** Labours hired for different field operations for principal crops/ha

| Crop  | Field preparation | Sowing/transplanting | Irrigation        |               | Weeding        |               | Harvesting |
|-------|-------------------|----------------------|-------------------|---------------|----------------|---------------|------------|
|       |                   |                      | No. of irrigation | No. of labour | No. of weeding | No. of labour |            |
| Jowar | 7                 | 6                    | —                 | —             | —              | —             | 16         |
| Wheat | 13                | 13                   | 5                 | 10            | —              | —             | 18         |
| ...   |                   |                      |                   |               |                |               | —          |
| ...   |                   |                      |                   |               |                |               | —          |
| Total | 20                | 19                   | 5                 | 10            | —              | —             | 34         |

Source Primary Survey (2011)

labours have you been hired and for which field operations. None of them have accessed/got required number of labours for agriculture work during the peak period (Table 11.4).

There are big gaps between demand and supply of agriculture labour during peak period of agricultural operations, especially harvesting in the Bundelkhand region,

UP, in 2011 (Table 11.5). For *Paddy* cultivation, 149 labours required per hectare and farmers have accessed only 54 due to various reasons. These are high wage rate and disinterest of labour for agricultural work. Whereas for *Wheat* cultivation, they hired 17 labours more than the required number of labour. Many of the farmers reported reasons for using more labour for wheat cultivation that they have not used machinery for sowing and harvesting. Farmers have hired labour for those field operations that could not be managed by family members as well as machinery such as transplanting of paddy and harvesting of other crops. None of them have hired labour for weeding that is most important field operation for kharif crops. Some of them hired labour for field preparatory works like cleaning of crop residues from field and manuring. A few of them also hired for irrigation, but all of them have hired for harvesting of crops. It is the general perception that cereal crops required more labour as compared to pulse crops for its cultivation. But, some of the growers have reported that green gram, black gram and cow pea required more labour for its harvesting in many slots. Actually, green/black gram required picking of pods (harvesting) two to three times because of crop physiological effects.

Accessibility of agriculture labour is also influenced by social relations between labour and farmer/landlord, type of field operations and nature of work. Labours are now very selective for nature of work and wage rate. Labour was found to be avoiding or refusing work as agricultural operations are hard and laborious and boring as well as have health hazards.

The requirement of labour for animal husbandry/livestock management varies from crop to crop. For livestock, labour should be skilled and educated to take care of animals for both milch animals and draught animals. Labour is required for sanitation, feeding, watering, breeding, health care, milking and security purpose. According to dairy economics, one cow (milch animal) needs  $\frac{1}{2}$  hours labour per day and one labour can take care of 10 milch animals/per day. Labour cost in livestock management is second rank after feeding cost, unlike in agriculture.

**Table 11.5** Average labour demand and supply gap in Bundelkhand region, 2011

| Crop                     | Agriculture form | Farmer hired lab/ha | Gap or shortage |
|--------------------------|------------------|---------------------|-----------------|
| Paddy                    | 149              | 54                  | 95              |
| Sorghum (Jowar)          | 56               | 41                  | 15              |
| Black gram (Urd)         | 76               | 37                  | 39              |
| Green Gram (Moong)       | 42               | 37                  | 5               |
| Red Gram (Arhar)         | 65               | 37                  | 28              |
| Sesame (Till)            | 89               | 21                  | 68              |
| Wheat                    | 42               | 59                  | -17             |
| Maize                    | 151              | na                  | na              |
| Ground nut (moong falli) | 168              | na                  | na              |
| Cotton                   | 268              | na                  | na              |
| Sugarcane                | 502              | na                  | na              |

Source Primary Survey (2011) and Agriculture University farm records



Access to labour is a matter of socio-economic status and relationship between farmers and labourers, but affordability of labour by farmers depends on their financial conditions such as wage rate and their ability to pay (Table 11.6).

### ***11.3.3 Affordability of Labour for Agriculture Work***

Affordability of labour for agriculture work on demand or at specific time of operations depends on economic status of farmers/landlord and also upon capacity of farmer to hire a required number of labours on every occasion. Accessibility of labour to the farmers is determined by relationship between both of them, but affordability of labour solely depends upon the economic status of the farmers. In the existing scenario, wage rate given under the MNREGA has become the starting point for all works in the rural areas and none of the labourers are accepting wage rate lower than that is given under the programme. Gestation period of crop is longer, and farm income is seasonal; it is hard for the farmer to pay wage on the spot. During the discussions in the village, a large farmer revealed that

Neither me nor my fore-fathers were manually engaged in agriculture. Suddenly this unfortunate thing has happened which I never expected in my dreams. I am unable to carry out agriculture, and if I lease out land in the form of share farming the farmers do not return an equal share to us. I am being cheated by the farmers (share cultivator). Whenever I need money I sell part of my land, and migrate to the urban areas. This has happened because of the labour shortage in agriculture and absence of bonded labour. Earlier bonded labour was working at very cheap rate and some of them working only on the interest of my loan. Now labour is costlier than gold and agriculture is not profitable thus I finally sell my land to solve my current financial needs.

Table 11.7 indicates that wage rate is varying from crop to crop and operations to operations. Most of the farmers have hired labour for harvesting by paying kind of same crop and paid cash for other field operations. They have reported increased wage rate that is more than their financial condition and hence were unable to hire labour. It is common perception and somewhat true in the sense that now productivity of land has reduced and cost of cultivation has increased. Farming is not profitable which is very true in a poor region like Bundelkhand. In this situation, farmers have two options, either to continue cultivation for survival or lease out land and migrate to urban area for livelihood. In this region, only businessmen and government employees are happy with all basic needs as well as daily needs, and most sufferers are middle and large farmers.

Agriculture needs time management which requires sufficient human resources (HR) and HR requires optimum wage rate on time. Thus, agriculture labour market is affected by time of cultivation, wage rate and labour supply on demand basis, because crop production stages cannot be changed in any condition for any crop in any geographic region. Table 11.8 lists the number of field operations, and labour demand varies for different crops. Prabakar et al. (2011) reported that nursery, main land preparation and transplanting require 62 person days/ha, first weeding and

**Table 11.6** Average labour hired by farmers for agricultural work, 2011

| Field operation |                      | Small     | Medium    | Large     | Total     |
|-----------------|----------------------|-----------|-----------|-----------|-----------|
| 1               | <i>Arhar</i>         |           |           |           |           |
|                 | Field preparation    | 7         | 10        | 12        | 10        |
|                 | Sowing               | 5         | 6         | 6         | 6         |
|                 | Harvesting           | 11        | 11        | 12        | 11        |
|                 | <b>Total</b>         | <b>22</b> | <b>26</b> | <b>30</b> | <b>26</b> |
|                 | For other operations | 10        | 11        | 12        | 11        |
| 2               | <i>Jowar</i>         |           |           |           |           |
|                 | Field preparation    | 6         | 7         | 8         | 7         |
|                 | Sowing               | 5         | 5         | 7         | 6         |
|                 | Harvesting           | 16        | 16        | 15        | 16        |
|                 | <b>Total</b>         | <b>23</b> | <b>25</b> | <b>29</b> | <b>26</b> |
|                 | For other operations | 15        | 15        | 15        | 15        |
| 3               | <i>Paddy</i>         |           |           |           |           |
|                 | Field preparation    | 11        | 11        | 10        | 11        |
|                 | Sowing               | 13        | 15        | 16        | 13        |
|                 | Harvesting           | 17        | 18        | 24        | 18        |
|                 | <b>Total</b>         | <b>35</b> | <b>39</b> | <b>50</b> | <b>37</b> |
|                 | For other operations | 17        | 18        | 22        | 17        |
| 4               | <i>Gram</i>          |           |           |           |           |
|                 | Field preparation    | 7         | 7         | 8         | 7         |
|                 | Sowing               | 5         | 6         | 6         | 6         |
|                 | Irrigation           | 5         | 5         | 6         | 6         |
|                 | Harvesting           | 14        | 16        | 16        | 16        |
|                 | <b>Total</b>         | <b>22</b> | <b>30</b> | <b>33</b> | <b>28</b> |
|                 | For other operations | 16        | 19        | 19        | 18        |
| 5               | <i>Wheat</i>         |           |           |           |           |
|                 | Field preparation    | 13        | 13        | 13        | 13        |
|                 | Sowing               | 12        | 13        | 13        | 13        |
|                 | Irrigation           | 14        | 15        | 16        | 15        |
|                 | Harvesting           | 15        | 18        | 19        | 18        |
|                 | <b>Total</b>         | <b>50</b> | <b>56</b> | <b>61</b> | <b>56</b> |
|                 | For other operations | 17        | 21        | 21        | 19        |
| 6               | <i>Lentil</i>        |           |           |           |           |
|                 | Field preparation    | 5         | 6         | 6         | 6         |
|                 | Sowing               | 6         | 8         | 8         | 8         |
|                 | Harvesting           | 13        | 14        | 14        | 13        |
|                 | <b>Total</b>         | <b>19</b> | <b>23</b> | <b>27</b> | <b>23</b> |
|                 | For other operations | 16        | 19        | 19        | 18        |
| 7               | <i>Mustard</i>       |           |           |           |           |
|                 | Field preparation    | 5         | 5         | 6         | 5         |
|                 | Sowing               | 6         | 8         | 9         | 8         |

(continued)

**Table 11.6** (continued)

| Field operation |                      | Small     | Medium    | Large     | Total     |
|-----------------|----------------------|-----------|-----------|-----------|-----------|
|                 | Irrigation           | 5         | 6         | 8         | 8         |
|                 | Harvesting           | 12        | 13        | 13        | 13        |
|                 | <b>Total</b>         | <b>18</b> | <b>21</b> | <b>27</b> | <b>22</b> |
|                 | For other operations | 16        | 19        | 19        | 18        |
| 8               | <i>Pea</i>           |           |           |           |           |
|                 | Field preparation    | 5         | 5         | 6         | 5         |
|                 | Sowing               | 6         | 8         | 7         | 7         |
|                 | Irrigation           | 5         | 6         | 6         | 6         |
|                 | Harvesting           | 12        | 12        | 12        | 12        |
|                 | <b>Total</b>         | <b>19</b> | <b>22</b> | <b>27</b> | <b>22</b> |
|                 | For other operations | 16        | 19        | 19        | 18        |

Source Primary Survey (2011)

Note Other operations (threshing, cleaning of grain, packing, loading, deloading, storing, etc.)

**Table 11.7** Wage rate and mode of payment for selected crops in 2005 and 2010

| Crop    | For harvesting in 2005 | For harvesting in 2010 | For others <sup>a</sup> in 2005 | For others <sup>a</sup> in 2010 |
|---------|------------------------|------------------------|---------------------------------|---------------------------------|
| Gram    | 4 kg                   | 4 kg                   | Rs. 80–90                       | Rs. 120–150                     |
| Arhar   | Rs. 80                 | Rs. 150                | Rs. 80–100                      | Rs. 120–150                     |
| Lentil  | 4 kg                   | 4 kg                   | Rs. 80–100                      | Rs. 120–150                     |
| Paddy   | 15–20 kg (paddy)       | 15–20 kg (paddy)       | 10–12 kg (rice)                 | 10–12 kg (rice)                 |
| Wheat   | 15–20 kg               | 20–22 kg               | Rs. 80–100                      | Rs. 120–150                     |
| Jowar   | 15–20 kg               | 20–22 kg               | Rs. 80–90                       | Rs. 120–150                     |
| Mustard | Rs. 80–100             | Rs. 150                | Rs. 80–90                       | Rs. 120–150                     |
| Till    | Rs. 80–100             | Rs. 150                | Rs. 80–100                      | Rs. 120–150                     |

Source Primary Survey (2011)

<sup>a</sup>Field preparation, composting/fertilizer, weeding, irrigation (except wheat), threshing, transportation (loading and deloading)

fertilizer application needed 47 person days/ha, second weeding and irrigation require 47 person days/ha and for harvesting 50 person days/ha were required for paddy cultivation. At present, labour is selective and free to choose any agricultural operation. Some of the farmers reported that labour has refused to work in selective field operations. These field operations are manuring/composting, weeding, cleaning, irrigation (during night), pesticide application (if any), loading and deloading of manure/farm yard manure and grain bags. Labour is now working with movement of clock and refused or asked extra pay for overtime work. Thus, labour

**Table 11.8** Compilation of field operations for different crops

|   |                                                          |       |                                |
|---|----------------------------------------------------------|-------|--------------------------------|
| 1 | <i>Manuring/composting (10–20 tonnes/ha)</i>             | 9     | <i>Disease management</i>      |
|   | – Loading and deloading                                  |       | Mechanical                     |
|   | – Spreading                                              |       | Chemical                       |
| 2 | <i>Field preparation</i>                                 | 10    | <i>Harvesting</i>              |
|   | By plough                                                |       | Manual                         |
|   | By tractor                                               |       | Harvester/combine              |
| 3 | <i>Improved varieties</i>                                | 11    | <i>Threshing</i>               |
| 4 | <i>Sowing/transplanting</i>                              |       | Manual                         |
|   | Line sowing                                              |       | Thresher                       |
|   | Spreading                                                |       | Bullock paddling               |
|   | Transplanting                                            | 12    | <i>Cleaning of grain/seed</i>  |
| 5 | Tractor/cultivator                                       |       | Benower                        |
|   | <i>Irrigation (if delayed, 5% yield reduced per day)</i> |       | Hand cleaning                  |
|   | Flooding                                                 | 13    | <i>Packaging</i>               |
|   | Check basin/bunding/furrow                               |       | In container                   |
| 6 | Sprinkler/drip                                           |       | In packet/bag                  |
|   | <i>Weeding (2–4 @ 15 days interval)</i>                  | 14    | <i>Storing</i>                 |
|   | Manual                                                   |       | Storage/dumping                |
|   | Mechanical                                               |       | Bags                           |
|   | Chemical                                                 |       | Containers                     |
| 7 | <i>Fertilizer and quantity (A, B, C, D)</i>              | 15    | <i>Marketing</i>               |
|   | Basal application                                        |       | Local market                   |
|   | Folliar application/spreading                            |       | Distance market                |
|   | Liquid application (with irrigation water)               |       | National/internal market       |
| 8 | <i>Insect pest control</i>                               | 12–15 | <i>Post-harvest management</i> |
|   | Mechanical                                               |       | Value addition of              |
|   | Chemical                                                 |       | products                       |

accessibility for agriculture work may not be affected by one factor. It is influenced by social status, economic status, nature of field operation, time of work, purpose of cultivation (commercial or), mode of payment and time of payment. Small and marginal farmers can manage cultivation by using family labour, but it is very hard for large farmers or commercial growers. As shown in Table 11.8, size of land-holding and hiring of labour is positively related and negatively correlated with use of family labour. The labour cost is the highest in operational cost of cultivation in all the crops (Tables 11.9 and 11.10).

**Table 11.9** Cost of wheat cultivation (Rs.), 2013

| Particulars  | Cost of cultivation (Rs.) by farm size |                    |                    |                    |
|--------------|----------------------------------------|--------------------|--------------------|--------------------|
|              | Small                                  | Medium             | Large              | Total              |
| Human labour | 7978.16<br>(19.39)                     | 7127.63<br>(15.65) | 6630.63<br>(13.73) | 6864.37<br>(14.99) |
| (a) Family   | 3716.64<br>(9.03)                      | 2000.50<br>(4.39)  | 1098.72<br>(2.28)  | 1835.47<br>(4.01)  |
| (b) Hired    | 4261.52<br>(10.36)                     | 5127.13<br>(11.26) | 5431.91<br>(11.25) | 5088.44<br>(11.11) |

Source [www.Indiastat.com](http://www.Indiastat.com)

Note Figures in parentheses are percentage of total cost

## 11.4 Factors Influencing Agriculture Labour Market

Various changes have been observed in both (rural and urban) labour markets in India over the period. As shown above, agriculture labour market is affected by various factors, of which time (field work), space (geographic location), purpose of cultivation (commercial) and wage differential are major factors. The general reasons of change in agriculture labour market reported in the literature are the following: rural out-migration (affects labour market both availability and affordability), MGNREGA and its wage rate and nature of work; disinterest of rural youth and farmers towards agriculture; political influence on labour impact of SP and BSP on OBC, SC/ST; wage differential and duration and nature of agriculture work; bond between labour and landlords has changed; non-agriculture sector is becoming the main source of income due to higher wages; farming less profitable.

Table 11.11 shows that the main reasons for reducing labour supply to agriculture are introduction of MGNREGA followed by out-migration and lack of interest in agriculture work. Respondents indicated that labour shortage in agriculture started in the 1990s, and acute labour shortage was felt after 2005. It indicates that economic reforms and employment guarantee schemes seriously affected the rural labour market in the study region. Taylor (2001) reported that rural out-migration reduces working population from place of origin that affects agriculture productivity negatively. The Bundelkhand region is not agriculturally advanced but it is the highest producer of pulses. Rural out-migration rate was higher in this region from 1991 to 2001.

Due to improvement of education level and urban life style or city bright light effects among rural educated youth is pushing from agriculture to non-agriculture sector. Youth, adult and farmers themselves are not taking interest in agricultural work even if they are offered higher wage rate. It is more common feelings among youth in almost villages at present scenario in this region. They perceive agricultural work to be low in status and less respectable job with no opportunity of skill development. Another factor behind changing rural labour market is political. In UP, association between labour and landlord has changed in various ways. Wage differential and duration of agriculture work is relatively more compared to other sectors which reduce supply of labour for farming. The welfare scheme such as PDS

**Table 11.10** Number of labour and labour cost share (%) in cost of cultivation in 2014

| Particulars           | No. of labour and % share of cost of cultivation in 2013-14 (Rs./ha) |        |                 |                  |                    |                  |                          |              |        |            |
|-----------------------|----------------------------------------------------------------------|--------|-----------------|------------------|--------------------|------------------|--------------------------|--------------|--------|------------|
|                       | Paddy                                                                | Maize  | Sorghum (Jowar) | Black gram (Urd) | Green gram (Moong) | Red gram (Arhar) | Ground nut (moong falli) | Sesum (Till) | Cotton | Sugar cane |
| No. of labourers      | 149                                                                  | 151    | 56              | 76               | 42                 | 65               | 168                      | 89           | 268    | 502        |
| Human labour          | 51.50                                                                | 53.47  | 58.16           | 65.48            | 48.09              | 56.24            | 56.59                    | 62.50        | 68.58  | 63.43      |
| Operational cost      | 74.53                                                                | 77.81  | 76.28           | 78.41            | 83.83              | 84.42            | 83.22                    | 76.39        | 82.85  | 72.73      |
| Fixed cost            | 16.38                                                                | 13.10  | 14.63           | 12.49            | 7.08               | 6.49             | 7.69                     | 14.52        | 8.06   | 18.18      |
| Managerial cost (10%) | 9.09                                                                 | 9.09   | 9.09            | 9.09             | 9.09               | 9.09             | 9.09                     | 9.09         | 9.09   | 9.09       |
| Total cost            | 74,039                                                               | 69,508 | 23,912          | 28,125           | 19,823             | 26,083           | 68,128                   | 35,741       | 90,002 | 207,699    |

Source Tamil Nadu Agricultural University

**Table 11.11** Changes in rural labour market in the Bundelkhand region, 2011

|   |                                       | Total |
|---|---------------------------------------|-------|
| 1 | <i>Reasons for labour shortage</i>    |       |
|   | Out-migration                         | 65.8  |
|   | MGNREGA                               | 71.7  |
|   | Lack of interest in agriculture work  | 62.5  |
| 2 | <i>When did labour shortage start</i> |       |
|   | Do not know but for 20 year           | 63.6  |
|   | Since 1990                            | 36.4  |
| 3 | <i>Acute labour shortage start</i>    |       |
|   | From last 20 years                    | 68.9  |
|   | 1990                                  | 9.7   |
|   | 1992                                  | 0.6   |
|   | 2006                                  | 20.8  |
|   | Total (N)                             | 360   |

Source Primary Survey (2011)

**Table 11.12** Hired agricultural labour market in Bundelkhand region, 2011

|   | Statement                                                  | District |          | Total |
|---|------------------------------------------------------------|----------|----------|-------|
|   |                                                            | Banda    | Hamirpur |       |
| 1 | <i>Farmers have got labour by paying higher wage rate</i>  |          |          |       |
|   | No                                                         | 24.4     | 46.7     | 35.6  |
|   | Yes                                                        | 75.6     | 53.3     | 64.4  |
|   | Total (N)                                                  | 180      | 180      | 360   |
| 2 | <i>Paid wage higher than minimum wage (MGNREGA)</i>        |          |          |       |
|   | Up to 50                                                   | 94.9     | 51.8     | 69.3  |
|   | 50+                                                        | 5.1      | 48.3     | 30.7  |
|   | Mean                                                       | 51       | 55       | 54    |
|   | Total (N)                                                  | 98       | 143      | 241   |
| 3 | <i>Got labour by offering high wage rate to the labour</i> |          |          |       |
|   | No                                                         | 26.5     | 50.4     | 40.7  |
|   | Yes                                                        | 73.5     | 49.7     | 59.3  |
|   | Total (N)                                                  | 98       | 143      | 241   |

Source Primary Survey (2011)

has supported saving of labour that forced people to look at another sector for more income. Some of farmers revealed their problems that labours are not available even they are ready to pay wage higher than MGNREGA and they have paid average Rs. 54 more wage than that of prevailing rate in the village. Around 41% of farmers have not got the required number of labour for agriculture work (Table 11.12).

Declining trends of agrarian worker have been observed in rural areas. Ratios between agrarian worker per 100 non-agrarian workers declined, and it is seeing that most of the states reported declining agriculture worker from 2001 to 2011.

If we look at region-wise, then in the central region of India, the ratio between agriculture and non-agriculture worker has declined whereas this ratio in south and west regions of India has increased. It has been also observed that ratio between agriculture workers per 100 cultivators has also declined from 2001 to 2011 (Table 11.13).

**Table 11.13** Workers ratio and percentage (%) change during 2001 and 2011

| Rural areas            | Ratio of agrarian worker per 100 non-agrarian <sup>a</sup> |            |           | Rural areas       | Ratio of agriculture labours per 100 cultivators |            |            |
|------------------------|------------------------------------------------------------|------------|-----------|-------------------|--------------------------------------------------|------------|------------|
|                        | 2001                                                       | 2011       | % Changes |                   | 2001                                             | 2011       | % Changes  |
| Jammu and Kashmir      | 121                                                        | 69         | -43       | Mizoram           | 4064                                             | 1368       | -66        |
| Himachal Pradesh       | 175                                                        | 117        | -34       | Jammu and Kashmir | 994                                              | 383        | -61        |
| Pondicherry            | 106                                                        | 70         | -33       | Delhi             | 440                                              | 193        | -56        |
| Jharkhand              | 256                                                        | 184        | -28       | Himachal Pradesh  | 3068                                             | 1379       | -55        |
| Dadra and Nagar Haveli | 103                                                        | 74         | -28       | Rajasthan         | 974                                              | 465        | -52        |
| Uttaranchal            | 213                                                        | 169        | -21       | Daman and Diu     | 646                                              | 328        | -49        |
| Bihar                  | 429                                                        | 342        | -20       | Nagaland          | 3960                                             | 2046       | -48        |
| Meghalaya              | 295                                                        | 239        | -19       | Uttar Pradesh     | 319                                              | 166        | -48        |
| Uttar Pradesh          | 318                                                        | 259        | -19       | Chandigarh        | 541                                              | 291        | -46        |
| Andaman and Nicobar Is | 33                                                         | 27         | -18       | Madhya Pradesh    | 232                                              | 125        | -46        |
| Sikkim                 | 137                                                        | 116        | -15       | Chhattisgarh      | 227                                              | 124        | -46        |
| Tamil Nadu             | 206                                                        | 176        | -15       | Arunachal Pradesh | 2324                                             | 1303       | -44        |
| Orissa                 | 208                                                        | 183        | -12       | Uttaranchal       | 797                                              | 456        | -43        |
| Rajasthan              | 289                                                        | 262        | -9        | Andhra Pradesh    | 77                                               | 47         | -39        |
| Nagaland               | 331                                                        | 308        | -7        | Haryana           | 375                                              | 234        | -38        |
| Arunachal Pradesh      | 246                                                        | 231        | -6        | Jharkhand         | 254                                              | 164        | -35        |
| Goa                    | 22                                                         | 21         | -5        | Sikkim            | 1119                                             | 736        | -34        |
| Karnataka              | 244                                                        | 239        | -2        | Tamil Nadu        | 85                                               | 56         | -34        |
| Chhattisgarh           | 537                                                        | 527        | -2        | <b>India</b>      | <b>167</b>                                       | <b>115</b> | <b>-32</b> |
| Tripura                | 125                                                        | 124        | -1        | Gujarat           | 158                                              | 109        | -31        |
| Kerala                 | 34                                                         | 34         | 0         | West Bengal       | 101                                              | 72         | -28        |
| Haryana                | 156                                                        | 156        | 0         | Karnataka         | 169                                              | 121        | -28        |
| <b>India</b>           | <b>240</b>                                                 | <b>241</b> | <b>0</b>  | Bihar             | 75                                               | 57         | -24        |

(continued)



**Table 11.13** (continued)

| Rural areas    | Ratio of agrarian worker per 100 non-agrarian <sup>a</sup> |      |           | Rural areas            | Ratio of agriculture labours per 100 cultivators |      |           |
|----------------|------------------------------------------------------------|------|-----------|------------------------|--------------------------------------------------|------|-----------|
|                | 2001                                                       | 2011 | % Changes |                        | 2001                                             | 2011 | % Changes |
| Assam          | 120                                                        | 120  | 1         | Maharashtra            | 137                                              | 107  | -22       |
| Daman and Diu  | 7                                                          | 7    | 1         | Tripura                | 151                                              | 124  | -18       |
| Mizoram        | 513                                                        | 521  | 2         | Andaman and Nicobar Is | 600                                              | 496  | -17       |
| Manipur        | 153                                                        | 156  | 2         | Orissa                 | 165                                              | 137  | -17       |
| Punjab         | 116                                                        | 121  | 5         | Assam                  | 423                                              | 351  | -17       |
| Madhya Pradesh | 514                                                        | 559  | 9         | Dadra and Nagar Haveli | 464                                              | 386  | -17       |
| West Bengal    | 125                                                        | 144  | 15        | Punjab                 | 186                                              | 159  | -14       |
| Maharashtra    | 374                                                        | 442  | 18        | Meghalaya              | 410                                              | 363  | -12       |
| Andhra Pradesh | 273                                                        | 323  | 18        | Goa                    | 265                                              | 256  | -3        |
| Chandigarh     | 4                                                          | 5    | 25        | Kerala                 | 59                                               | 63   | 7         |
| Gujarat        | 211                                                        | 283  | 34        | Pondicherry            | 18                                               | 19   | 8         |
| Delhi          | 11                                                         | 18   | 67        | Manipur                | 795                                              | 953  | 20        |

*Regional Variation (India)*

|            |     |     |     |            |     |     |     |
|------------|-----|-----|-----|------------|-----|-----|-----|
| Central    | 372 | 330 | -11 | Central    | 283 | 150 | -47 |
| East       | 226 | 209 | -8  | North      | 580 | 353 | -39 |
| North      | 189 | 181 | -5  | South      | 95  | 65  | -32 |
| North east | 144 | 140 | -3  | West       | 143 | 108 | -25 |
| South      | 194 | 206 | 6   | East       | 105 | 79  | -25 |
| West       | 295 | 372 | 26  | North East | 472 | 388 | -18 |

<sup>a</sup>Agrarian worker = main agriculture labour + main cultivator, non-agrarian = main household workers + main others

Source Registrar General, India (2001a, 2011)

### ***11.4.1 Impact of Changes in Agriculture Labour Market on Cropping Patterns***

Labour is an active input in crop production. Its supply and demand brings many structural changes in agriculture such as changes in cropping pattern, cropping intensity, crop rotation, use of improved seeds, application of production technology, quality and quantity of products. Farmer wants to grow crops which are more profitable, easy to grow, have market demand, longer shelf life (good storage quality), low labour intensive, etc. Agriculture is facing acute labour shortage, or supply of labour is lower than demand in agriculture during peak period which may compel farmers to change cropping pattern from high labour-intensive crop or

technology to low labour-intensive crop or technology. General perception is that agriculture labours are in abundance at one time and short in another time, because agriculture work is seasonal, and labours are more aware about wage differentials; in this situation, they prefer non-agriculture work for longer duration or out-migrate from farming areas. Vetrivel and Manigandan (2013) reported that after sowing and after harvesting of crops there is no more work in agriculture. In the Bundelkhand region, many crops have disappeared from cropping patterns. Higher labour requiring crops farmers are not growing because they were unable to access labour during sowing and harvesting.

It has been observed that farmers are discouraged from farming due to lack of labour during field operations. Farmers of one study village have stopped paddy cultivation and reduced area under cultivation of onion and other vegetable crops. These are the farmers, who had bonded labour in the past. The consequences of labour shortage in agriculture have been observed in the Bundelkhand region as listed below.

- Change in cropping pattern and intensity: low labour-intensive crops and mono-cropping;
- Lack of crop rotation and diversification in agriculture having affected soil fertility;
- Field operation timings change;
- Affected quality and quantity of produce because of avoiding weeding and manuring in the field;
- Changes in land market—leased out or remain uncultivated (fallow);
- Soil fertility degraded because of less manuring and composting into field by lease;
- Reduction in milch animals or farm animals;
- Use of female family labour by the large high-caste farmers;
- Changes in wage rate due to gap in supply and demand.

Table 11.14 shows changes in the cropping pattern. This change has been observed seriously after 2005 when MGNREGA was implemented in this region that reduced labour supply to agriculture and enhanced agriculture wage rate that farmers could not pay. One-third of them have not grown two crops in a year even though some of them have irrigation facility and have tractors. During discussion with a group of farmers, it was found that they are unable to grow groundnut, sugarcane, paddy, onion, vegetables, etc., only because of labour shortage and higher wage rate for agriculture work. In case, they could manage to sow these crops by using tractor and seed drill, then problems are faced during harvesting. It is discouraging the farming community.

**Table 11.14** Cropping pattern affected by labour shortage in Bundelkhand region, 2011

| Item |                                          | Percentage |
|------|------------------------------------------|------------|
| 1    | Grow more than two crops                 | 67.2       |
|      | Total (N)                                | 360        |
| 2    | Areas under multiple crops               |            |
|      | 1–2 ha                                   | 50.8       |
|      | 3+                                       | 49.2       |
|      | Mean                                     | 33         |
|      | Total (N)                                | 242        |
| 3    | Reason for not growing more than 2 crops |            |
|      | Anna animals                             | 76.3       |
|      | Low labour availability                  | 22.9       |
|      | Total (N)                                | 118        |

Source Primary Survey (2011)

A vegetable crop requires higher number of labour, and most of the farmers have stopped vegetable growing if there is no support of their family labour. Vegetable crops have more opportunity for value addition and increase farm income, but it also requires more labour. Another high-value crops are pulses and required lesser number, but at present these crop growers are also suffering from labour shortage. Prasad and Saini (2010) found that low labour availability was the main reason to avoid value addition in vegetable crops in Punjab, even most of them were aware about value addition methods. A study by Awasthi and Prasad (2010) in the Bundelkhand region on chick pea (gram) production found that labour shortage is one of the main constraints in gram cultivation. Another study by Awasthi et al. (2011) on pulse production technology reported the same constraints in the same study area.

Changes in the cropping pattern affect both farm income and soil fertility. If there is labour shortage, farmers will adopt mono-cropping and avoid crop rotations that degrade soil fertility. Most of the farmers want to grow multiple cropping. They have reported that our family members are not supporting and labour is not available during peak work, and in case labour available then ask higher wage on the spot. Because of labour shortage during harvesting period, a large farmer in Banda district has leased out whole cultivated land to other cultivators those have either sufficient family labour or have capacity to pay higher wage rate. Table 11.15 reveals the cropping pattern changes after 2005 and area under high labour requiring crops to low labour requiring crops in the Bundelkhand region, UP by migrant and non-migrant households.

**Table 11.15** Area (ha) under cereals and pulse crops before 2005 and at present (2010–11)

| Item |                                                         | NMH  | MH   | Total (N) | Chi-sq. |
|------|---------------------------------------------------------|------|------|-----------|---------|
| 1    | Area under cereal crop cultivation in 2005              |      |      |           |         |
|      | One hectare                                             | 48.8 | 51.2 | 215       | 0.289   |
|      | More than two hectare                                   | 51.7 | 48.3 | 145       |         |
| 2    | Area under cereal crop in 2010 year                     |      |      |           |         |
|      | One hectare                                             | 49.6 | 50.4 | 236       | 0.049   |
|      | More than two hectare                                   | 50.8 | 49.2 | 124       |         |
| 3    | Reason of decreasing/increasing area under cereal crops |      |      |           |         |
|      | No change                                               | 46.1 | 53.9 | 271       | 9.108*  |
|      | Due to introduction of high-yielding variety            | 100  |      | 5         |         |
|      | Low grain consumption household                         | 55.6 | 44.4 | 9         |         |
|      | Wheat/paddy requires more labour/cost                   | 60.6 | 39.4 | 66        |         |
|      | PDS provides sufficient grain                           | 60   | 40   | 10        |         |
| 4    | Area under pulse crop cultivation in 2005               |      |      |           |         |
|      | One hectare                                             | 52.3 | 47.7 | 176       | 0.711   |
|      | More than two hectare                                   | 47.8 | 52.2 | 184       |         |
| 5    | Area under pulse crop in 2010 year                      |      |      |           |         |
|      | One hectare                                             | 51.8 | 48.2 | 110       | 0.209   |
|      | More than two hectare                                   | 49.2 | 50.8 | 250       |         |
| 6    | Reason of decreasing/increasing area under pulse crops  |      |      |           |         |
|      | No change                                               | 48.4 | 51.6 | 169       | 7.492*  |
|      | It requires low burden of labour/irrigation             | 52.9 | 47.1 | 87        |         |
|      | Government is promoting pulse crops                     | 15.4 | 84.6 | 13        |         |
|      | More income/unit area                                   | 54.5 | 45.5 | 99        |         |

Source Primary survey (2011)

Note: MH/NMH Migrant/non-migrant household

## 11.5 Main Findings

There are various factors that bring changes in rural labour market of which migration is considered to be the most important one. Rural out-migration influences demand and supply of labour and wage rate in the places of origin. This chapter attempted to evaluate the emerging trends in rural labour market in the Bundelkhand region in Uttar Pradesh, factors behind labour shortages and its impact on the cropping pattern. The analysis is based on primary survey of farmers and secondary data sources.

The analysis reveals that the region is affected by labour availability, accessibility and affordability. The ratio between agriculture worker and non-agriculture worker is declining and so is the ratio between agriculture labour and cultivator in most of the Indian states. Migration to urban and non-farm activities, introduction of MNREGA, low wage rate in farming, education and awareness that farm work is less remunerative and has low status are some of the factors that have dissuaded labour to opt for non-farm work. The consequent shortages in labour for agricultural work witnessed in the region seem to be adversely affecting cropping pattern and

productivity of land. Low labour-intensive crops and mono-cropping are major changes that appeared in rural areas due to high gap in supply and demand (low supply and high demand during cropping season) of agriculture labour. Most of the farmers have stopped vegetable cultivation and have reduced the number of milch animals. Farming seems to be a residual sector being done by those who cannot do other work. Illiterate, old age males and females, poor and unskilled are the main food growers in the region. Cropping intensity was found to be higher in households having sufficient family labour.

The labour shortages in agriculture could be managed through mechanization but it has many limitations. There are high initial costs, seasonal usage, maintenance cost and presence of small land size holding. Farmers have adopted labour saving technology such as reaper, harvester, and combine for harvesting. But these technologies are costlier. Other possible solutions to overcome labour shortage in the agriculture sector may be cooperative farming and introduction of MGNREGA in agriculture with subsidized wage rate.

## Annexure

See Tables 11.16 and 11.17.

**Table 11.16** Characteristics of sampled HH (average) (year 2011)

| Farm size          | No. of HH | Age of head of household | Education of head of HH (years of schooling) | Family size | No. of male adults | No. of female adults | No. migrated |
|--------------------|-----------|--------------------------|----------------------------------------------|-------------|--------------------|----------------------|--------------|
| <i>Migrant</i>     |           |                          |                                              |             |                    |                      |              |
| Small              | 66        | 50.6                     | 8                                            | 6.5         | 2.1                | 1.5                  | 2.1          |
| Medium             | 62        | 45.2                     | 8                                            | 6.2         | 2.2                | 1.5                  | 1.9          |
| Large              | 52        | 51.9                     | 10                                           | 7.3         | 2.6                | 1.8                  | 1.8          |
| Total              | 180       | 49.1                     | 8                                            | 6.6         | 2.3                | 1.6                  | 1.9          |
| <i>Non-migrant</i> |           |                          |                                              |             |                    |                      |              |
| Small              | 57        | 47.6                     | 8                                            | 6.7         | 2.3                | 1.5                  |              |
| Medium             | 62        | 47.2                     | 8                                            | 7.1         | 2.3                | 1.8                  |              |
| Large              | 61        | 51.0                     | 10                                           | 7.5         | 2.7                | 2.0                  |              |
| Total              | 180       | 48.6                     | 8                                            | 7.1         | 2.5                | 1.8                  |              |
| <i>All HH</i>      |           |                          |                                              |             |                    |                      |              |
| Small              | 123       | 49.2                     | 8                                            | 6.6         | 2.2                | 1.5                  | 1.1          |
| Medium             | 124       | 46.2                     | 8                                            | 6.7         | 2.3                | 1.6                  | 0.9          |
| Large              | 113       | 51.4                     | 8                                            | 7.4         | 2.7                | 1.9                  | 0.8          |
| Total              | 360       | 48.9                     | 8                                            | 6.9         | 2.4                | 1.7                  | 1.0          |

Source Primary survey (2011)

HH Household

**Table 11.17** Net operated area and net irrigated area (ha) (average), 2011

| Farm size category    | Number surveyed | Net operated area | Total own area | Own irrigated area | Total leased out area | Total leased-in area | Leased-in area as % of NOA | Rent of leased out Rs./Acre | Rent of leased-in Rs./Acre | Gross cropped area | Cropping Intensity |
|-----------------------|-----------------|-------------------|----------------|--------------------|-----------------------|----------------------|----------------------------|-----------------------------|----------------------------|--------------------|--------------------|
| <i>Migrant HH</i>     |                 |                   |                |                    |                       |                      |                            |                             |                            |                    |                    |
| Small                 | 66              | 0.86              | 0.75           | 0.75               | 0.60                  | 0.71                 | 82.6                       | 3000                        | 3000                       | 0.9890             | 140.1              |
| Medium                | 62              | 1.97              | 1.75           | 1.67               | 0.65                  | 0.87                 | 44.2                       | 3000                        | 3000                       | 2.3314             | 133.2              |
| Large                 | 52              | 3.36              | 5.49           | 4.44               | 2.83                  | 0.70                 | 20.9                       | 3000                        | 3000                       | 6.4196             | 121.9              |
| Total                 | 180             | 1.76              | 2.47           | 2.13               | 1.46                  | 0.76                 | 43.1                       | 3000                        | 3000                       | 3.0202             | 132.5              |
| <i>Non-migrant HH</i> |                 |                   |                |                    |                       |                      |                            |                             |                            |                    |                    |
| Small                 | 57              | 0.72              | 0.61           | 0.45               | 0.49                  | 0.61                 | 84.2                       | 3000                        | 3000                       | 0.8421             | 146.7              |
| Medium                | 62              | 1.39              | 1.72           | 1.33               | 0.96                  | 0.64                 | 45.7                       | 3000                        | 3000                       | 2.2111             | 131.0              |
| Large                 | 61              | 5.56              | 6.69           | 6.33               | 1.84                  | 0.71                 | 12.7                       | 3000                        | 3000                       | 8.3249             | 132.3              |
| Total                 | 180             | 2.42              | 3.05           | 2.74               | 1.27                  | 0.64                 | 26.6                       | 3000                        | 3000                       | 3.8495             | 136.4              |
| <i>All HH</i>         |                 |                   |                |                    |                       |                      |                            |                             |                            |                    |                    |
| Small                 | 123             | 0.80              | 0.68           | 0.61               | 0.55                  | 0.67                 | 83.9                       | 3000                        | 3000                       | 0.9209             | 143.2              |
| Medium                | 124             | 1.72              | 1.73           | 1.50               | 0.78                  | 0.77                 | 44.8                       | 3000                        | 3000                       | 2.2713             | 132.1              |
| Large                 | 113             | 4.54              | 6.14           | 5.46               | 2.31                  | 0.71                 | 15.6                       | 3000                        | 3000                       | 7.4481             | 127.5              |
| Total                 | 360             | 2.10              | 2.76           | 2.44               | 1.37                  | 0.71                 |                            | 3000                        | 3000                       | 3.4348             | 134.4              |

Source Primary Survey (2011)

HH Household

Note Three systems of land leasing in the study area, i.e., Balkat, share cropping (Batai) and Gahan (Girvi). Rate of lease in and lease out as Balkat is Rs. 1100–1500 per bigha (Rs. 5500–7500/ha)

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# Chapter 12

## Determinants of Rural Nonfarm Employment and Its Implication for Rural Income Distribution: A Case Study of Assam

Anamika Das

### 12.1 Introduction

With an increasing pressure of population growth on agricultural land and the failure of rural industries to absorb the growing surplus labour, the importance of nonfarm sector (RNF) has increased immensely in recent decades. Till 1960s, development economists emphasized on the two-sector growth model, propounded by Lewis (1954), Fei and Ranis (1964), whereby surplus labour from the agriculture sector would be uninterruptedly absorbed by the steadily expanding modern (largely urban-based and capital intensive) industrial sector (Chadha 1993). But the ineffectiveness of this model in reducing rural unemployment and gradual expansion of rural nonfarm activities make policymakers to look at this sector as an alternative source of employment. The background paper of World Development Report 1995 defines RNF sector which includes all economic activities in rural areas, except agriculture, livestock, fishing and hunting. RNF sector is a heterogeneous sector that includes activities undertaken by farm households as independent producers in their home, the subcontracting of work to farm families by urban-based firms, nonfarm activities in villages and rural town enterprises (Lanjouw Jean and Lanjouw 1995). Rural workers commuting to their place of work which may not be rurally located also fall under the purview.

In the context of developing countries, the importance of the RNF sector is manifold. It not only contributes to the growth of rural employment but also to the growth of output and minimizes rural urban migration. Asian countries such as China, Malaysia and Indonesia have witnessed growing importance of the RNF sector since the 1980s. China witnessed the growth of RNF workers from 11% of total rural employment in 1980 to 20% in 1986. Town and village enterprises of China experienced 23.4 and 12.7% of annual rate of growth of real output and

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employment, respectively, over the period 1978–86 (Lanjouw Jean and Lanjouw 1995). In Malaysia, 50% of rural labour was in the nonfarm sector in 1980 (Islam 1987). In Indonesia, rural services, commerce, manufacturing and construction absorbed more rural labour than agriculture during the period 1971–1980 (Islam 1987). Farm management surveys and time allocation studies of South African households report that 15–65% of farmers have secondary occupation in the non-farm sector, and 15–40% of total family labour hours are spent on income-generating nonfarm activities (Haggblade et al. 1989).

The significance of RNF sector in India is visible both in terms of its share in rural employment and rural income. The NSS data show an increase in the share of RNF employment from 27.3% in 2004–05 to 35.9% in 2011–12. Further, about 48% of the average rural households' income comes from the nonfarm sector (Dubey 2008). The RNF sector also acts as a substitute for credit as in the slack period people can earn their livelihood by engaging in it instead of taking loan at exorbitant rates of interest.

In a country like India where poverty level is high, growing interest among academia and policymakers on nonfarm sector stems from the implication it has for poverty. Composition of employment status in the nonfarm sector has also undergone changes in the post-reform period. There is decline in self-employment and an increase in casualization of wage labour over the period 1972–73 to 1993–94 (Chadha 1997; Unni and Rani 2005). A continuous decline of regular employment in the post-reform period has been reported (Jatav and Sen 2013).

In this backdrop, it is important to identify the rural people joining the nonfarm sector, their employment status and what makes them join the nonfarm sector. In the context of developing countries, an important hypothesis on expansion of employment in RNF is based on distress drive (Chadha 2002; Sahu 2003; Himanshu 2007). According to this, the RNF sector acts as a residual sector absorbing those rural workers who are pushed out of agriculture. These unskilled workers join nonfarm sector as casual labour with little implications for poverty reduction. A number of studies (Reardon 1998; Ellis 2000; Himanshu 2007) have categorized the reasons behind livelihood diversification due to necessity or by choice which correspond to push versus pull factors. The earnings of RNF workers may vary based on their employment status.<sup>1</sup> Those who join the nonfarm sector as casual labour earn much lower than those who are in well paid regular jobs. This raises the question of distribution of RNF income. Some studies (Reardon 1998; Hossain 2004; Leones and Feldman 1998; Adams Richard 2002) analysed the distribution of nonfarm income across landholding classes. There are some cases of declining share of nonfarm income in the total household income despite an increase in the absolute level of nonfarm incomes as total income or land size of households increase. Hossain (2004) noted that Bangladesh witnessed an unequal distribution of rural nonfarm income over the period 1987–2000.

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<sup>1</sup>As per employment status, RNF workers are categorized as self-employed, casual and salaried in NSS reports.

In this backdrop, this chapter attempts to study the composition and determinants of RNF employment in Assam. It also focuses on the distribution of RNF income across different landholding classes based on evidence from a primary survey in the state. RNF employment in Assam has increased from 21% in 1993–94 to 38% in 2011–12 (NSS 68th round data). Assam is one of the least urbanized states of India located in the north-eastern region of India. Seven out of every eight people still live in rural Assam (HDR Assam 2003). Compared to the all-India figure of 25.70%, as many as 33.89% people live below poverty line in rural Assam in 2011–12 (Planning Commission 2013). The shift from traditional farming, largely subsistence-oriented systems to modern, technologically advanced and market-oriented agriculture has taken place slowly in the state and is uneven in its spread. Most importantly, uncertainties and vagaries of nature such as regular occurrence of flood continue to overwhelm agriculture. Therefore, it is imperative to examine the role that the nonfarm sector plays in improving rural livelihood, especially when the capacity of agriculture to support people is limited.

The chapter is structured in the following way. The subsequent section describes the data sources, sampling design for the primary survey undertaken and methodology. Section 12.3 analyses the trends and composition of rural nonfarm employment in the states. This is followed by an empirical estimation of the determinants of RNF employment and the distributional aspects of rural nonfarm income. The last section concludes.

## 12.2 Data Sources and Sampling Design for Primary Survey

The study is based on both primary and secondary source of data. Among the secondary data sources, we study the trend and composition of RNF employment in Assam in terms of its share in total rural workers using unit-level data from NSS 50th, 61st and 68th round data. The total workers are defined considering their principal and subsidiary status together and nonfarm workers as those who work in industries other than agriculture and allied activities as defined by NIC codes using principal and subsidiary status together. Taking clue from Chadha (1997), Seth (1992), Jatav and Sen (2013), we also include in rural nonfarm workers who reside in rural areas but commute to nearby urban centres for work. The secondary data used in the study pertain to NSS unit-level data for the period 2011/12. The issue of distributional aspects of RNF income is analysed using the primary data. The rationale for relying on primary data is that income data are not available in the NSS. Moreover, secondary data sources such as NSS and Census underestimate the share of nonfarm employment in rural areas. Though NSS fully captures labour

allocation patterns throughout the year, it tends to overlook local factors determining rural worker's participation in nonfarm sector.

Using 2011 census data, we divide the districts of Assam into high, medium and low category, based on the percentage share of rural nonfarm employment. We choose medium category districts as the percentage shares of RNF employment of medium category districts resemble that of overall Assam, which reports 43.74% in 2011 population census (Fig. 12.1). We randomly select Barpeta district from the medium category district. Two villages are selected randomly from this district. A sample of 60 households from each of the two villages is selected. Two pretested semi-structured questionnaires are implemented, one at the household level and the other at individual level for members engaged in nonfarm jobs.

In order to analyse the factors influencing individual's decision to join nonfarm sector, a logit regression used as follows.

$$\ln[p/(1 - p)]_i = \beta_1 + \beta_2 X_{2i} + \dots + \beta_7 X_{7i} + U_i$$

- $p$  is the probability that the event  $Y$  (dependent variable) occurs,  $p(Y = 1)$ , i.e.,  $Y = 1$  if the worker joins the nonfarm sector.
- $p/(1 - p)$  is the "odds ratio."
- $\ln[p/(1 - p)]$  is the log odds ratio, or "logit."
- $\alpha$  is the intercept term and  $\beta_s$  are the coefficients of independent variables  $X_{is}$ .
- $U_{is}$  are the error terms.

The dependent variable is a dichotomous variable that takes 1 if the person joins the nonfarm sector and 0 otherwise. Farm (0) and nonfarm (1) workers are defined by NIC 2008 codes taking usual principal and subsidiary status together. Independent variables considered in our model are sex, level of education, caste, amount of land cultivated and ratio of dependent member (age below 15 and above 60) in the family of rural workers (while using secondary data). To understand the effect of local factors on nonfarm participation, we use village dummy in addition to the variables mentioned earlier while studying the determinants based on primary data. The distribution of nonfarm income in both absolute level and its share across different landholding classes has also been analysed.



## 12.3 Trends in Rural Nonfarm Employment in Assam

The share of RNF in total employment was low in Assam during the 1970s and 1980s, particularly compared to the states which witnessed high agricultural growth (Chadha 1997). Though the RNF employment shows an upward trend towards the end of 1980s, it got reversed in the early years of reforms. The share of male workers engaged in RNF to total male workers in Assam declined to 21.8% in 1993–94 from 23.5% in 1987–88. The share of female workers engaged in RNF sector to total female workers though quite lower than the male counterpart exhibits a similar trend, with the share declining from 17.7% in 1987–88 to 16.8% in 1993–94 (Chadha 1997).

In the post-1993 period, the state saw a rebound in the rural nonfarm employment, with its share increasing from 20.8% in 1993–94 to 37.97% in 2011–12 (NSS 50th and 68th round reports). The share of nonfarm workers in total male rural workers in Assam has increased over this period. The share of nonfarm workers in total female rural workers has however declined from 16.8% in 1993–94 to 11.7 in 2011–12, but again increased in 2011–12.

In terms of the sectoral composition of the nonfarm sector, construction has emerged as the most important sector, accounting for bulk of the employment generated. The sector has witnessed highest positive percentage change for both male and female workers. Within RNF sector, male employment is more diversified compared to those in females, indicating that the female does not have equal access to jobs in many sectors. Participation of females is mostly concentrated in “other services” and trade and hotel in 2011–12 (Table 12.1). Notably, the quality of jobs generated in the RNF sector is poor. Most of the jobs generated in the sector are casual and self-employed in nature, with the share of salaried workers declining over the period.

**Table 12.1** Trend of percentage share of rural workers (principal + subsidiary) across different broad industry categories

| Industry                        | 1993–94 |      |        | 2004–05 |      |        | 2011–12 |       |        |
|---------------------------------|---------|------|--------|---------|------|--------|---------|-------|--------|
|                                 | Persons | Male | Female | Persons | Male | Female | Persons | Male  | Female |
| Agriculture and allied activity | 79.2    | 78.2 | 83.2   | 74.3    | 69.6 | 88.3   | 62.03   | 58.6  | 79.04  |
| <i>Nonfarm sector</i>           |         |      |        |         |      |        |         |       |        |
| Mining and quarrying            | 0.2     | 0.2  | –      | 0.3     | 0.3  | –      | 0.18    | 0.16  | 0.25   |
| Manufacturing                   | 3.5     | 2.2  | 8.7    | 3.1     | 2.9  | 3.7    | 5.49    | 5.91  | 3.4    |
| Electricity                     | 0.3     | 0.3  | –      | 0.1     | 0.2  | –      | 0.02    | 0.02  | –      |
| Construction                    | 0.7     | 0.8  | 0.1    | 2.5     | 3    | 0.8    | 6.57    | 7.26  | 3.13   |
| Trade, hotel and restaurant     | 6.9     | 8.2  | 1.9    | 9       | 11.6 | 1.1    | 12.84   | 14.66 | 3.8    |

Source Calculated from NSS (50th, 61st and 68th rounds unit-level data)

### 12.3.1 Education and Caste Profile of Farm and Nonfarm Workers in Assam

Poor education level and caste profile act as entry barrier for workers in joining nonfarm sector (Jatav and Sen 2013). Table 12.2 reports the education and caste profile of farm and nonfarm workers for the period 2011–12. More than 70% of illiterate workers in rural Assam are in the farm sector. The share of workers in the nonfarm gets higher with the level of education. However, significant share of illiterate and less-educated workers in the nonfarm sector raises the question of quality of jobs generated in the nonfarm sector.

Most of the casual workers engaged in the nonfarm sector are either illiterate or have low level of education (Table 12.3). However, workers with medium or higher than medium level of education have better access to salaried jobs. Interestingly, the shares of both illiterate and higher educated are low in self-employed workers. This indicates that illiterate and workers with low level of education are mostly engaged in low-quality jobs.

Both male and female workers across social groups have higher share in agriculture than non-agricultural sector. However, the distribution of rural workers across farm and nonfarm sectors is more skewed towards the farm sector in case of STs and OBCs than other categories (Table 12.4).

**Table 12.2** Education and caste profile of farm and nonfarm workers for the period 2011–12 (based on NSS 68th round data)

| Education level                                                       | Farm  | Nonfarm | Total |
|-----------------------------------------------------------------------|-------|---------|-------|
| Illiterate                                                            | 73.82 | 26.18   | 100   |
| Literate without formal schooling, below primary or primary education | 68.0  | 32.0    | 100   |
| Medium and secondary                                                  | 59.34 | 40.66   | 100   |
| Higher secondary and diploma holder                                   | 29.47 | 70.53   | 100   |
| Graduate and above                                                    | 25.81 | 74.19   | 100   |

Source Calculated from NSS (50th, 61st and 68th rounds unit-level data)

**Table 12.3** Distribution of RNF workers with different status of work across education levels

| Education                                                              | Self-employed | Salaried | Casual |
|------------------------------------------------------------------------|---------------|----------|--------|
| Illiterate                                                             | 6.6           | 4.26     | 24.97  |
| Literate without formal schooling, below primary and primary education | 37.7          | 12.7     | 34.96  |
| Medium and secondary                                                   | 43.5          | 31.1     | 34.02  |
| Higher secondary and diploma holder                                    | 9.49          | 27       | 4.12   |
| Graduate and above                                                     | 2.76          | 24.9     | 1.92   |
| Total                                                                  | 100           | 100      | 100    |

Source Calculated from NSS (50th, 61st and 68th rounds) unit-level data

**Table 12.4** Distribution of rural workers of different castes in farm and nonfarm sectors in Assam (2011–12)

| Social group | All   |         | Male  |         | Female |         |
|--------------|-------|---------|-------|---------|--------|---------|
|              | Farm  | Nonfarm | Farm  | Nonfarm | Farm   | Nonfarm |
| ST           | 74.01 | 25.99   | 69.73 | 30.27   | 89.66  | 10.34   |
| SC           | 57.07 | 42.93   | 55.16 | 44.84   | 67.24  | 32.76   |
| OBC          | 66.73 | 33.27   | 62.74 | 37.26   | 80.41  | 19.59   |
| Others       | 55.57 | 44.43   | 53.25 | 46.75   | 73.55  | 26.45   |

*Source* Calculated from NSS (68th round) unit-level data

As mentioned above, the estimates of nonfarm employment based on secondary data sources such as NSS and Census data have some limitations. NSS and Census data on nonfarm workers underestimate the share of nonfarm employment in rural areas. Though these data sources try to record secondary occupations, they fail to fully capture the labour allocation patterns throughout the year (Chandrasekhar 1993). Besides, secondary data sources fail to capture region-specific factors that may influence a household's participation in rural nonfarm sector. To complement the findings from the secondary data, we use data from a primary survey carried out in two villages viz. Salekura and Borbarizar.

### 12.3.2 A Brief Profile of Sample Households

We define our sample households in both the villages in terms of members working in the farm and nonfarm sectors. Here, the total working members of the household are defined by usual principal and subsidiary status, as adopted by NSS. We define nonfarm workers as workers who work in industries other than agriculture and allied activities defined by NIC codes, considering principal and subsidiary status together. The important nonfarm occupations in the two villages are wage labourers, drivers, tailors, small traders, shopkeepers, carpenters, weavers, cooks, Asha workers and government servants such as teachers, anganwadi workers and other government jobs. The dominant occupation in the nonfarm sector is wage labour that accounts for 30% of the total nonfarm workers followed by carpenters (11%) and traders (11%).

The qualitative study indicates another dominating source of nonfarm income of rich or households with higher land size is interest earning. Rich rural people lend money to poor, landless rural people at exorbitant rates of interest. Most of these poor are Muslims. Based on the extant literature on the subject, we consider rural nonfarm workers as those whose place of residence is rural but they commute to urban centres for work. We divide the households in three categories/types. Type (1) households are those in which all the working members work in nonfarm sector. Type (2) households have all the working members working only in agriculture and allied activities. In type (3) households, some of the working members work on

farms while others work in the nonfarm sector. The interviews with key informants including the *Gaonburha* (the village head) suggest that most households in the two villages earn their livelihood from their engagement in both farm and nonfarm sectors. Almost all the households approached had livestock to support their consumption needs; however, few maintain them for commercial purposes.

Land is an important asset of rural households and degrees of nonfarm participation varies across landholdings. Landless households constitute the bulk in category type I. A significant share of both marginal and small landholding households diversify their livelihood. Households with large farm size are also the ones with members working in farm and nonfarm sectors (Table 12.5).

Across the two villages, the sample consists of 280 workers as defined by usual principal and subsidiary status. Following the definition of usual principal and subsidiary status taken together, 44% of workers work in farm and 56% of workers work in nonfarm sector. As much as 59% of male workers work in the nonfarm sector that compares with only 48% of female workers' participation in the nonfarm sector.

As shown in Table 12.6, a higher share of illiterate workers is found to be involved in the nonfarm sector compared to the farm sector. A similar trend is also noted for workers with education level more than higher secondary, tentatively suggesting a U-shaped relation between education and participation in nonfarm activities. Significantly higher participation by illiterate workers in the nonfarm sector may indicate a greater role for push factors than pull factors. This trend is however at variance with what we observe at the state level, where most illiterate workers are found to be engaged in the agriculture sector.

The distribution of nonfarm workers across different levels of education also indicates the significant presence of illiterate workers in the nonfarm sector. Almost 50% of the male workers engaged in the nonfarm sector are either illiterate or

**Table 12.5** Percentage distribution of households as per land across varied nonfarm participation

| Group of cropped areas                        | Households |            |            | Total    |
|-----------------------------------------------|------------|------------|------------|----------|
|                                               | Type (1)   | Type (2)   | Type (3)   |          |
| Landless                                      | 91.89 (34) | 2.7 (1)    | 5.41 (2)   | 100 (37) |
| Marginal (up to 2.5 acre)                     | 2.82 (2)   | 19.72 (14) | 77.46 (55) | 100 (71) |
| Small (up to 5 acre)                          | 0          | 22.22 (2)  | 77.78 (7)  | 9        |
| Semi-medium, medium and large (above 5 acres) | 0          | 0          | 100 (3)    | 3        |

Source Primary survey

Type (1) households are those with all the working members of the households working in the nonfarm sector

Type (2) households are those with all working members working in the farm sector

Type (3) households are those households whose members work in both the farm and nonfarm sectors



**Table 12.6** Distribution of workers with different level of education across farm and nonfarm sectors

| Level of education           | All   |         | Male  |         | Female |         |
|------------------------------|-------|---------|-------|---------|--------|---------|
|                              | Farm  | Nonfarm | Farm  | Nonfarm | Farm   | Nonfarm |
| Illiterate                   | 47.31 | 52.69   | 46.03 | 53.97   | 50.00  | 50.00   |
| Up to primary                | 45.83 | 54.17   | 40.00 | 60.00   | 75.00  | 25.00   |
| Middle and secondary         | 45.24 | 54.76   | 39.39 | 60.61   | 66.67  | 33.33   |
| Higher secondary and diploma | 31.25 | 68.75   | 33.33 | 66.67   | 20.00  | 80.00   |
| Graduate and above           | 34.78 | 65.22   | 42.11 | 57.89   | 0.00   | 100.00  |

Source Primary survey

**Table 12.7** Percentage distribution of nonfarm workers across different levels of education

| Level of education           | All   | Male  | Female |
|------------------------------|-------|-------|--------|
| Illiterate                   | 31.01 | 32.95 | 26.77  |
| Up to primary                | 16.46 | 18.18 | 18.90  |
| Middle and secondary         | 29.11 | 29.55 | 31.50  |
| Higher secondary and diploma | 13.92 | 10.23 | 14.17  |
| Graduate and above           | 9.49  | 9.09  | 8.66   |
| Total                        | 100   | 100   | 100    |

Source Primary survey

educated up to the primary level (Table 12.7). More than 40% of the female workers engaged in the nonfarm sector report similar education status. Thus, significant presence of illiterate or less-educated workers in the nonfarm sector indicates that jobs taken up by the sample workers in the region are of poor quality devoid of any skills.

The distribution of nonfarm workers also reflects a pattern, with self-employment being the most important mode of employment, followed by wage labour and salaried workers. As much as 51% of nonfarm workers are self-employed and 29% are wage labour. Salaried nonfarm workers constitute only 19% of the total nonfarm workers. The distribution of workers, when disaggregated over males and females, reflects a similar pattern. As mentioned earlier, the degree of nonfarm participation varies across landholdings. Higher participation in the nonfarm sector is noticed among landless as well as workers with cultivated land more than 5 acres. In contrast, moderate participation in the nonfarm sector is noticed among workers with medium and small size of land (Table 12.8). This tentatively suggests the U-shaped relation between the cultivated land and nonfarm employment.

Nonfarm activity participation also varies across the age of workers. Younger workers have better access to the nonfarm sector than the older ones. The rural workers in the age group of 14–40 years have higher share in the nonfarm sector than the farm. However, workers above 40 years have higher share in agriculture. Further, a significant percentage of workers from ST and other categories join the

**Table 12.8** Percentage distribution of workers with different size of land cultivated across farm and nonfarm sector

| Land cultivated                               | Farm  | Nonfarm | Total |
|-----------------------------------------------|-------|---------|-------|
| Landless                                      | 9.59  | 90.41   | 100   |
| Marginal (up to 2.5 acres)                    | 53.66 | 46.34   | 100   |
| Small (2.5–5)                                 | 69.70 | 30.30   | 100   |
| Semi-medium, medium and large (above 5 acres) | 40    | 60      | 100   |

Source Primary survey

**Table 12.9** Results of logit regression on the determinants of rural nonfarm employment

| Independent variable                    | Coefficient  | Std. Err. | $p > z$ |
|-----------------------------------------|--------------|-----------|---------|
| Sex: male (RC)                          | −0.98***     | 0.13      | 0.00    |
| <i>Education level: illiterate (RC)</i> |              |           |         |
| Primary                                 | 0.52***      | 0.15      | 0.00    |
| Medium and secondary                    | 0.91***      | 0.15      | 0.00    |
| Higher secondary and diploma            | 2.23***      | 0.20      | 0.00    |
| Graduate and above                      | 3.01***      | 0.26      | 0.00    |
| <i>Caste: ST (RC)</i>                   |              |           |         |
| SC                                      | −0.05        | 0.16      | 0.76    |
| OBC                                     | −0.03        | 0.13      | 0.81    |
| Others                                  | 0.13         | 0.12      | 0.29    |
| Land cultivated                         | (−) 0.001*** | 0.00      | 0.00    |
| Land cultivated squared                 | 0.001***     | 0.00      | 0.00    |
| Dependency ratio of household           | 0.19         | 0.21      | 0.37    |
| Constant                                | −0.12        | 0.52      | 0.00    |

Number of observations = 2836, LR  $\chi^2$  (11) = 738.30, Prob >  $\chi^2$  = 0.000, Pseudo  $R^2$  = 0.1915; RC means reference category, coefficient with \*\*\* are significant at 1%

nonfarm sector. As much as 82% of ST workers in the sample are in the nonfarm sector. This is in contrast with the overall situation in the state where ST workers tend to be concentrated in the farm sector.

## 12.4 Determinants of RNF Participation Based on NSS

This section focuses on the factors that determine RNF employment. This is examined for rural workers in the states based on the NSS 68th round data, that is, for the period 2011–12 based on a logit regression. The dependent variable is a dichotomous variable that takes value 1 if the person joins the nonfarm sector and 0 otherwise. Results are furnished in Table 12.9. It shows that sex, level of education and land cultivated influence nonfarm participation of rural workers in Assam. The negative sign of the coefficient of the variable sex indicates that compared to males,

females are less likely to join the nonfarm sector in Assam. Unequal access of female in the nonfarm sector has been documented in many studies (Chadha 1997; Unni and Rani 2005; Jatav and Sen 2013; Binswanger 2013).

The probability of participation in the nonfarm sector increases with education, indicating that education acts as an entry barrier for rural workers joining the nonfarm sector. It validates the findings in the extant literature (Chadha 1997; Unni and Rani 2005; Jatav and Sen 2013; Binswanger 2013). The negative coefficient of land cultivated indicates that rural workers with less amount of cultivable land are more likely to join the nonfarm sector, indicating that participation is driven by push factors. Similar findings were obtained for earlier periods in Thorat (1993) on an inverse relationship between landholding and the share of rural households engaged in nonfarm sector for 1977–78, 1983–84 and 1987–88.

However, a positive sign of the square term of land cultivated indicates a nonlinear relationship between landholding and participation in nonfarm activities. This tentatively suggests that the relationship between rural nonfarm participation and land cultivated is U-shaped curve. Such relationship between RNF participation and asset holding has also been noted in Kenya and Vietnam (Evans and Ngau 1991). As the asset holding/income of the household rises, the tendency of diversifying towards the RNF sector decreases until a threshold level is reached. After crossing this asset/income level, any increase in assets/income results in a tendency to invest the surplus on the RNF sector activities. Interestingly, caste and ratio of dependent members do not have any impact on rural nonfarm activity participation.

Overall, results depict a mixed picture showing the significance of both push and pull factors towards moving into the RNF for work. As the level of education of rural workers increases, they are more likely to join the nonfarm sector for higher returns. However, a U-shaped relationship between land cultivated and nonfarm participation indicates that rural workers with less cultivable land are pushed out of agriculture, but beyond a threshold of land ownership, the shift may be driven by the motivation to invest their surplus income in the nonfarm sector.

#### ***12.4.1 Determinants of Rural Nonfarm Employment in the Surveyed Villages***

A re-examination of the same question using primary data lends credence to the result noted in the secondary data. The results of logistic regression confirm the importance of land scarcity, sex, age, education of rural workers in nonfarm participation (Table 12.10). Compared to illiterate rural workers, workers with education level higher secondary and diploma are more likely to join the nonfarm sector. The negatively significant coefficient of the variable sex indicates that compared to males, females are less likely to join the nonfarm sector. The age of rural workers also has significant impact on nonfarm participation. Generally, old rural people do not want to leave their traditional farming occupation. That apart,

**Table 12.10** Result of logit regression

| Independent variable                    | Coefficient | Std. Err. | $p > z$ |
|-----------------------------------------|-------------|-----------|---------|
| <i>Education level: illiterate (RC)</i> |             |           |         |
| Up to primary                           | 0.083       | 0.436     | 0.849   |
| Middle and secondary                    | -0.083      | 0.379     | 0.827   |
| Higher secondary and diploma            | 0.876*      | 0.510     | 0.086   |
| Graduate and above                      | 0.803       | 0.560     | 0.152   |
| Total cropped area                      | -1.935***   | 0.327     | 0       |
| Total cropped area square               | 0.277***    | 0.054     | 0       |
| Sex: Male(RC)                           | -0.863**    | 0.360     | 0.016   |
| Village dummy: village Borbarizar (RC)  | 0.841**     | 0.381     | 0.027   |
| Age                                     | -0.029***   | 0.011     | 0.009   |
| <i>Caste: SC (RC)</i>                   |             |           |         |
| ST                                      | 1.576**     | 0.687     | 0.022   |
| OBC                                     | 0.000       | (empty)   |         |
| Others                                  | 0.233*      | 0.410     | 0.57    |
| Constant                                | 2.731***    | 0.871     | 0.002   |

Number of observations = 275, LR  $\chi^2$  (11) = 71.48, Prob >  $\chi^2$  = 0.000, Pseudo  $R^2$  = 0.1903; coefficient with single, double and triple stars indicate level of significance at 10, 5 and 1%, respectively. RC means reference category

young workers have higher adaptability to learn skills to join the nonfarm sector. Binswanger (2013) states that young and educated rural workers, particularly males, can have better access to nonfarm sector. Primary data also confirm the U-shaped relationship between cropped area and participation in nonfarm activities.

When we control region-specific factors through region dummies (with Borbarizar as reference category), the coefficient of the region dummy is found to be positive and significant. This suggests that workers from Salekura, a village frequently ravaged by flood, are more likely to join the nonfarm sector. This can be explained in terms of the insight from Ellis (2000) who argues that rural people diversify their livelihood for desperate reason such as natural disaster (e.g. flood) when the chance of crop failure is high. Interestingly, compared to SC, ST and workers from other category are more likely to join the nonfarm sector. However, this is at variance with our results at the state level which show that the caste of a rural worker does not have any significant impact on his joining the nonfarm sector.

#### 12.4.2 Distribution of Nonfarm Income Across Landholding Classes

The distribution of nonfarm income across households with different sizes of landholdings indicates workers with more than 5 acres of land have disproportionate

**Table 12.11** Distribution of RNF workers across landholding classes

| Land owned                            | Share of RNF workers |
|---------------------------------------|----------------------|
| Landless                              | 41.77                |
| Marginal (up to 2.5 acre)             | 48.1                 |
| Small (2.5–5 acre)                    | 6.33                 |
| Semi, medium and large (above 5 acre) | 3.8                  |
| Total                                 | 100                  |

*Source* Calculated from primary survey

**Table 12.12** Distribution of absolute and share of nonfarm income in the total household income across households with different landholdings

| Land owned                            | Average nonfarm income | Percentage of total nonfarm income | Share of average nonfarm income in the average household income |
|---------------------------------------|------------------------|------------------------------------|-----------------------------------------------------------------|
| Landless                              | 61,837.84              | 18.28                              | 87.47                                                           |
| Marginal (up to 2.5 acre)             | 69652.8                | 20.6                               | 69.00                                                           |
| Small (2.5–5 acre)                    | 73,200                 | 21.64                              | 51.32                                                           |
| Semi, medium and large (above 5 acre) | 133,500                | 39.47                              | 44.54                                                           |

*Source* Calculated from primary survey

claim over the income accruing from nonfarm sector. While they account for about 40% of total nonfarm income, the remaining 60% is distributed among landless, marginal and small size of landholders indicating skewed distribution of rural nonfarm income. However, nonfarm workers with more than 5 acres of land account for only 4% of the total nonfarm workers (Table 12.11).

The share of nonfarm income in the total household income declines as the size of landholding of household increases even though the absolute level of nonfarm income increases (Table 12.12). Reardon (1998) has noted this trend in a number of case studies. As already noted in the review, landless, low-skilled rural workers face substantial entry barriers in the remunerative nonfarm activities. They join nonfarm sector in low-paid casual jobs with little time for farm works. Though their share of nonfarm income in total income is high, absolute income from nonfarm sector is low.

## 12.5 Conclusion

The chapter examines the trend, composition and determinants of RNF employment in Assam using NSSO unit-level data and household level primary survey of 280 workers carried out in two villages. Given that there may be local region-specific

factors which may influence participation in the nonfarm sector, the chapter also revisits the same question using primary data collected from two villages chosen from Barpeta district. Further, the question of distributional aspects of nonfarm income cannot be answered by relying on the secondary data as it does not have information on the income earned by rural households from different sources. The chapter makes an attempt to answer this question using the household survey data collected.

Assam has witnessed an increasing trend in the share of RNF employment over the period from 1993–94 to 2011–12. The state has witnessed an increase in rural employment in all the industrial categories of nonfarm sector except mining and electricity. Construction sector accounts for the highest percentage change in the share of rural employment in the state, followed by trade, hotel and restaurant. The quality of jobs generated in the rural nonfarm employment has also declined as evident in the increase in the share of rural self-employed and casual workers in nonfarm sector with continuous fall in the share of salaried workers. A disaggregation of RNF employment in terms of sex shows that male rural nonfarm employment has witnessed the highest percentage change in the construction sector, followed by the manufacturing sector. As regards female participation in rural nonfarm employment, the percentage change in female participation in RNF employment is highest in the construction sector over the period from 1993–94 to 2011–12, but the percentage change in their participation in manufacturing sector has been negative over the same period. On the whole, the manufacturing sector in Assam accounted for only 5.49% of rural workers in 2011–12. Manufacturing sector in the state also includes most of the traditional nonfarm sector such as weaving, manufacturing of silk such as *muga*, *paat*, *eri*, manufacturing of brass utensils and jewelleryes. This indicates that none of the traditional sectors is generating much rural employment.

The determinants of RNF employment at the individual level signifies that both push and pull factors are in operation when it comes to participating in the nonfarm sector. As the level of education of rural workers increases, they are more likely to join nonfarm sector for higher returns. However, a U-shaped relationship between land cultivated and nonfarm participation indicates that rural workers with little or no cultivable land are being pushed out of agriculture and those with higher cultivable land may be lured to the nonfarm sector by the possibility of higher potential returns of their investment of surplus generated in the agriculture sector.

As regards the distributional consequence of nonfarm participation, evidence based on primary data points towards unequal distribution of rural nonfarm income, which is more likely to be concentrated among the households with larger size of land compared to those with smaller size of landholding. It may suggest that rural workers with better access to resources are benefited more relative to their poorer counterparts who face entry barriers in remunerative nonfarm jobs. Though there has been an expansion of RNF employment in Assam over the study period, the quality of jobs generated in the sector is of concern. There is hardly any job creation in the traditional nonfarm sectors such as weaving, manufacturing of silk and brass

utensils. Most of the expansion of jobs in RNF has occurred in construction and trade, hotel and restaurant where most of the workers are casual and self-employed.

Finally, the U-shaped relationship between land cultivated and nonfarm participation indicates that some resource-poor rural people are joining low-quality nonfarm jobs to support their fragile livelihood, but the relatively better off people with access to resources, both physical and social, take up more remunerative nonfarm jobs. This necessitates appropriate actions and programmes by the government to impart education and skills to the rural workers so that movement of workers from the farm to nonfarm sector is driven by better opportunities and higher earnings.

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# Chapter 13

## Changes in Work Patterns of Rural Women in the Context of Structural Transformation in India

Nancy Sebastian

### 13.1 Introduction

The recent decline in women's work participation, especially in rural areas, has caught the interest of many researchers at a time when the economy is witnessing high growth rate and rising income. Various studies have pointed out that the factors affecting women labour force participation are different from that of males. The economic, social and cultural factors are intertwined for women while deciding to participate in the workforce. When it comes to women's work outside the household realm, the 'Role Incompatibility' theory<sup>1</sup> is stressed upon. Women are expected to adhere to the household duties (Lobel 1991). For working women, there could be role strain in balancing both work and family thereby; women might be compelled to withdraw to attend to domestic duties. Therefore, part-time work becomes the only solution to balance work with family responsibilities (Chaudhary and Verick 2014). Further, job opportunities for women tend to be limited apart from being poorly paid and hazardous (Khera and Nayak 2009). In the same light, the authors argue that providing 'productive employment' opportunities to women requires more attention and effort than raising their low participation rates (Chaudhary and Verick 2014). It is therefore important to understand the behaviour of women's participation rates in order to design better policies to increase opportunities for the marginalized women, thereby helping to reduce the existing levels of inequality (Mizala et al. 1999).

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<sup>1</sup>Work-family conflict refers to a condition whereby participation in one of the roles either is incompatible with participation in the other role in some respect or makes participation in the other more difficult (Greenhaus and Beutell 1985; Kahn et al. 1964).

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The current rural labour market is witnessing a structural transformation but has limited job options for women other than agricultural work. Women often engage in multiple activities for additional income (Unni 1996). The work patterns for rural women may change when non-farm employment opportunities such as under the Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA) arise. In this study, we try to seek answers to changes in rural women's work patterns. First, what determines their choice of one job over the other? Does participation in government employment programmes such as MGNREGA reduce farm participation in terms of days of labour supplied to agriculture? Has the number of labour days supplied in farm activities reduced for women as compared to men due to MGNREGA? Are women moving out of low remunerated farm work or is farm work still their main activity? A plethora of cross-sectional studies based on NSS data have already attempted to answer these questions. However, cross-sectional studies can reveal only the decline or increase in the women's participation over time. In contrast, the panel data structure allows to track the same households and individuals over a period of time, which enables one to analyse changes in their work patterns, evaluate the effect of government schemes in terms of changes in work participation, impact on poverty status of households overtime, etc. More importantly, it helps in identifying women moving out of farm work or reducing their number of days in it and rural women who are still continuing. This chapter utilizes the IHDS<sup>2</sup> panel data for the years 2005 and 2012 to answer the questions raised above.

The chapter is broadly structured into four sections. The first section provides the background and key researchable issues taken up. The second section analyses changes in the patterns of work which includes labour market transitions for rural women, determinants of their job choice, growth in wages in agriculture and non-farm jobs over time and impact of rural women's participation in MGNREGA on poverty of the household. The third section explains the determinants of labour being supplied by rural women workers in farm activities and whether participation in agriculture has reduced for rural women. The last section draws conclusions from the analysis.

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<sup>2</sup>This survey is a collaborative research program between the National Council of Applied Economic Research and the University of Maryland. IHDS panel data set (at individual level) which had mainly two waves, IHDS-I (2004–05) and IHDS-II (2011–12). It happens to be India's first nationally representative panel data survey.

### 13.2 Changing Patterns of Work of Rural Women in the Context of MGNREGA

Kumar et al. (2011) define 'employment diversification' as the shifting of workforce from one sector to the other, for employment. The proportion of this workforce engaged in different sectors of the economy, constitute the 'structure of employment'. The study has revealed that an increasing rural non-farm employment has positive and significant effect on reducing rural poverty at the all-India level. Further there is an evident shift towards non-farm sector (Reddy et al. 2014). Fisher et al. (1997) emphasize that non-farm employment is particularly important to small and marginal farmers, as well as the landless, who cannot derive sufficient income from the agricultural sector. Moreover, it is an important safety net to rural households in times of agricultural distress. Due to the structural transformation that the rural economy of India is currently undergoing, there has been an evident shift from agriculture to non-agriculture work options like MGNREGA. The implementation of MGNREGA<sup>3</sup> seems to have changed the whole scenario by making employment programme in rural areas comprehensive and women specific. Rural labour market is becoming increasingly competitive and diversified, leading to a rise in the real wages (Chand and Srivastava 2014).

Abraham (2009) claims that the stagnation in rural wage rates, declining employment opportunities in the agricultural sector and sustained wage differential between farm and non-farm sector together probably had pushed employment in the rural non-farm sector. Jatav and Sen (2013) argue that though non-farm employment in rural areas is primarily distress-driven, there are some significant entry barriers for workers in the non-farm sector in terms of education, age and gender. There has, however, been an increase in casual employment in the non-farm sector, which has been particularly high for women workers. This has led to a process of feminization of casual employment in this sector (Ibid).

In the context of decline in women's work participation in recent years, Chand and Srivastava (2014) explained it by the withdrawal of women labour from agriculture due to an improvement in economic conditions of families, rising education pursuits and low preference for farm work. Women have been found to be shifting out of low-paying self-employment activities choosing either to study or devote themselves to domestic duties. Kak (1994) observes that women keep getting in and out of the labour market due to the seasonal nature of employment in the agricultural sector and act more like the reserve army of labour to be employed at peak times, on low wages. Moreover, Garikipati and Pfaffenzeller (2010) argued

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<sup>3</sup>The Act places no restriction on how each household's quota of 100 days is shared within the household, wage earned is equal for both men and women (Khera and Nayak 2009) and have fixed hours of work. Several aspects of work provided under MGNREGA program are particularly gender friendly. It is available within 5 km radius of home, one-third of the work is to be reserved for women, basic worksite facilities are to be made available including childcare facilities when more than 5 children under 6 years of age are present at the worksite, equal wages are to be offered to men and women.

that while men are moving into non-farm jobs and self-employment, it is the women who are being left behind to take over as agricultural labour, receiving low pay and social status. Further, ample studies indicate that agriculture work is being feminized. The trends based on the NSS data reveal that during the period 1983–84 to 2011–12, the relative pace of shift from agriculture to non-agriculture had been very slow for women wherein they experienced a 10% point decline while males experienced 18% point during the same period. Hence, it becomes important to analyse whether rural women are moving out of farm work or does farm work continue to be their main activity? In the latter case, what are the socio-economic characteristics of these women found reducing their days of labour? To what extent is MGNREGA responsible for labour market transitions of rural women, trends in the wage rate and impact on the poverty status of the household?

An analysis of women's work participation basically takes two forms. One is a participation decision (whether or not to enter the labour market) and another is how much to work (how many labour days to supply?). Labour supply has been less focussed on Indian literature, and thus, the need to examine the determinants of labour supply becomes important especially for farm work, which is still the main activity of majority of rural women workers. Bardhan's work (1979) was one of the first attempts to estimate labour supply functions for poor agrarian households. Bardhan (1979) suggests a positive relation between wage rate and hours of work supplied by agricultural household as opposed to a horizontal labour supply curve often asserted in development literature. Rural women hailing from agriculturally developed areas and those belonging to backward caste are more likely to be in the workforce. Wales and Woodland (1980) consider various methods of estimating labour supply functions when some individuals in the sample do not work. In the labour supply context, there is sample selectivity issue, since the individual has the choice of whether or not to work and hence whether he would be included in the subsample of workers. Further, in an empirical research by Eberharter (2003), variables such as age, education, economic and demographic characteristics, social attitudes and gender role schemes are found to influence the annual working hours with regard to labour supply. Dasgupta and Goldar (2005) find a downward sloping (or forward falling) labour supply function for poor rural women workers. Thus, 'forced employment' or 'need-based participation in workforce' for women from BPL families in rural areas was evident from the results. Bhalotra and Aponte (2010) investigated the cyclicity in women's labour supply motivated by the hypothesis that it contributes to smoothing the household consumption during episodes of income volatility.

The utilization of panel data set of India Human Development Survey (IHDS) gives us the unique opportunity to explore the changes in work patterns for rural women when schemes such as MGNREGA are put in place during period the 2005–2012. We attempt to analyse determinants of their choice of one job over the other using multinomial logistic regression. More specifically, the determinants of farm labour supplied by rural women are examined using Heckman selection technique when employment schemes such as MGNREGA are in place, to examine the changes, if any, to farm labour supplied by rural woman. A total sample of 48,800 rural women workers has been utilized in the panel dataset. In 2012, at the

cross section level, a total sample of 67,940 rural women was available out of which 29% (around 20,000) were in workforce<sup>4</sup>. Out of the total, only 2% (1,951) are MGNREGA workers (worked for more than 240 h) in 2012.

### 13.2.1 *Labour Market Transitions of Rural Women*

In order to analyse the transitions of work for rural females during the period 2005–2012 based on IHDS panel data, we have divided the activities in broad and detailed categories of work as shown in Tables 13.1 and 13.2. Table 13.1 highlights the need for more job opportunities in productive employment, farm work being less productive and low remunerative. Maximum proportion (41%) of combined workers (those engaged in both farm and non-farm works) in 2012 were farm workers in 2005, indicating that farm sector is still low remunerated and requires additional days of work to supplement income. It shows that around 45% of rural women farm workers in 2012 were not in workforce previously in 2005. Possibly, given the limited amount of jobs available and high entry barriers in most of the non-farm jobs, majority (49%) still remain farm workers. As for MGNREGA, it is just an additional income opportunity for women as also observed by other studies like Grown (2006), Pellissery and Jalan (2011), Chari (2006).

Table 13.3 shows that majority (70%) of rural women combine MGNREGA with farm work, and only 30% of them do exclusive MGNREGA work. Table 13.2 shows the detailed division of work and how the work pattern for rural women has changed over the period 2005–2012. It shows that regular salaried jobs, attracted majority of the rural women in 2012 who were not in workforce in 2005. This explains the preference for better regular jobs for entry into workforce.

Further, we observe that workforce participation rates (WPR) of rural female are the highest in farm in both the rounds in panel data but at the same time employment growth of agriculture sector has declined for them (Table 13.4). As Table 13.5 clearly shows agriculture employment growth as measured by CAGR<sup>5</sup> has declined by 4%, industry and service sector employment has grown during period for rural females. Service sector growth particularly has shown a rise for rural women of over 12%. Table 13.3 which shows the detailed sample distribution of rural women workers in farm and non-farm activity reveals that majority (76%) are own farm workers (self-employed) and remaining only 24% are agriculture labourers within farm work category. Among the non-farm workers, most of them are non-farm wage labourers (62%), followed by business and salaried workers.

<sup>4</sup>Here the definition of work includes workers engaged in either animal care, own nonfarm business, non-farm wage work, agriculture wage work, own family farm work or salaried work for more than 240 h.

<sup>5</sup>Compound Annual Growth Rate (CAGR) calculated as  $[(\text{End value}/\text{Beginning value})^{(1/\text{number of years})}] - 1$ .

**Table 13.1** Broad division of occupation of workers of 2012 in 2005 (column percentages)

| Variables                  | No work <sup>a</sup> | Farm work <sup>b</sup> | Non-farm work <sup>c</sup> | Farm and non-farm work | MGNREGA | MGNREGA and farm | Any MGNREGA work |
|----------------------------|----------------------|------------------------|----------------------------|------------------------|---------|------------------|------------------|
| No work <sup>a</sup>       | 83.13                | 45.03                  | 54.33                      | 36.08                  | 47.19   | 23.56            | 29.41            |
| Farm work <sup>b</sup>     | 13.52                | 49.21                  | 16.39                      | 40.96                  | 35.18   | 58.01            | 52.36            |
| Non-farm work <sup>c</sup> | 2.47                 | 2.01                   | 25.68                      | 8.52                   | 11.83   | 5.87             | 7.35             |
| Farm and non-farm work     | 0.88                 | 3.75                   | 3.6                        | 14.44                  | 5.8     | 12.56            | 10.88            |
| Total                      | 100                  | 100                    | 100                        | 100                    | 100     | 100              | 100              |

Source Author's calculation from IHDS-I and IHDS-II

Note <sup>a</sup>No work: not in workforce

<sup>b</sup>non-farm work includes non-agricultural wage labour, salary and own business in 2005 and includes non-agricultural wage labour (excluding MGNREGA), own business, salary in 2012

<sup>c</sup>farm work includes own farm work and agricultural labourer (excluding animal care)

**Table 13.2** Detailed division of occupation of workers of 2012 in 2005 (column percentages)

| Work categories        | <sup>a</sup> No work | Agriculture laboratory | Own farm | Salary | Business | <sup>b</sup> Non-farm (excluding MGNREGA) | Any MGNREGA | Exclusive MGNREGA |
|------------------------|----------------------|------------------------|----------|--------|----------|-------------------------------------------|-------------|-------------------|
| No work                | 83.81                | 40.76                  | 30.57    | 46.36  | 37.71    | 34.69                                     | 38.81       | 43.98             |
| Agriculture laboratory | 2.96                 | 35.01                  | 16.23    | 3.46   | 10.46    | 22.2                                      | 11.91       | 28.69             |
| Own farm               | 1.65                 | 8.95                   | 26.8     | 7.35   | 8.58     | 13.04                                     | 12.35       | 3.69              |
| Non-farm               | 1.3                  | 3.8                    | 5.5      | 3.09   | 8.02     | 6.6                                       | 16.15       | 5.74              |
| Salary                 | 8.42                 | 8.42                   | 18.19    | 38.11  | 19.46    | 18.51                                     | 17.43       | 12.75             |
| Business               | 1.86                 | 3.07                   | 2.7      | 1.63   | 15.77    | 4.96                                      | 3.36        | 5.14              |
| Total                  | 100                  | 100                    | 100      | 100    | 100      | 100                                       | 100         | 100               |

Source Author's calculation from IHDS-I and IHDS-II

Note <sup>a</sup>No work: not in workforce

<sup>b</sup>MGNREGA as exclusive MGNREGA worker or combined with any other work

**Table 13.3** Detailed sample distribution of rural female farm and non-farm worker in 2012

| Non-farm work category | Percentage | Farm work category | Percentage | MGNREGA category                    | Percentage |
|------------------------|------------|--------------------|------------|-------------------------------------|------------|
| Non-agriculture        | 62.33      | Agriculture labour | 23.64      | MGNREGA and agriculture wage labour | 30.63      |
| Business               | 20.23      | Own farm labour    | 76.36      | MGNRGEA and Own farm                | 37.02      |
| Salaried               | 17.44      |                    |            | MGNREGA exclusive                   | 32.36      |
| Total                  | 100        | Total              | 100        | Total                               | 100        |

Source Author's calculation from IHDS-I and IHDS-II

**Table 13.4** WPR for different occupation of rural women

| 2012                         | Sample | WPR (above 22 years) | 2005                         | Sample | WPR (above 15 years) |
|------------------------------|--------|----------------------|------------------------------|--------|----------------------|
| Own farm                     | 9,376  | 29.04                | Own farm                     | 9,491  | 29.15                |
| Agriculture labour           | 5,351  | 16.57                | Agriculture labour           | 5,928  | 18.21                |
| Business                     | 459    | 1.42                 | Business                     | 1,061  | 3.26                 |
| Salaried                     | 6,111  | 18.92                | Salaried                     | 7,440  | 22.86                |
| Any MGNREGA                  | 1,766  | 5.47                 | Any MGNREGA                  |        |                      |
| Non-farm (excluding MGNREGA) | 1,615  | 5                    | Non-farm (excluding MGNREGA) | 1,338  | 4.11                 |
| Not in work                  | 17,886 | 55.39                | Not in work                  | 23,148 | 60.88                |
| in work                      | 14,406 | 44.61                | In work                      | 14,871 | 39.12                |
| Total                        | 32,292 | 100                  | Total                        | 38,019 | 100                  |

Source Author's own calculation from IHDS-I and IHDS-II

**Table 13.5** Rural women participation sector-wise

| Sector <sup>a</sup> | 2012 | 2005 | CAGR |
|---------------------|------|------|------|
| Agriculture         | 60   | 78   | -4   |
| Industry            | 8    | 7    | 2    |
| Service             | 32   | 14   | 12   |

Source Author's calculation from IHDS-I and IHDS-II

<sup>a</sup>According to CSO broad division of industry

### 13.2.2 Choice of Work Among the Rural Women Workers

Multinomial Logit Regression is run for rural women workers using cross-sectional data of IHDS-2012 to assess the determinants of choosing a particular type of work. The dependent variable is a categorical variable, includes five outcomes, thereby



four equations. Participation in farm work (own farm or agricultural labourer), which is the base outcome, non-farm work (non-agricultural labourer excluding MGNREGA, own business, salaried work), combined (farm and non-farm work), MGNREGA (exclusive), MGNREGA combined with farm work. Independent variables include same variables as those used in computing farm labour supply function. Multinomial occupation choice modelling as depicted by Table 13.6 shows the marginal probability of opting for different types of work as compared to farm work (base category):

- (a) Rural women are more likely to participate in non-farm work with rising level of education, income and for those who are Muslims, Christian (compared to forward caste). Non-farm work, on the other hand, has entry barriers.
- (b) Rural women are less likely to participate in combined work (farm and non-farm) especially those belonging to richest income quintile, those with education beyond middle school, women with more number of infants in the household. However, OBCs, Dalit, Adivasi and widowed rural women are more likely to be in combined work than just farm work.
- (c) Rural women are more likely to be in MGNREGA for those who are Dalits, Christians and those with middle school education. However, those women with higher number of infants in household, unmarried, those belonging to the highest income quintile (richest) category and those with graduate and above level of education are less likely to participate in MGNREGA than farm work.

### 13.2.3 Wage Rate and Impact of MGNREGA on Poverty

Table 13.7 shows that the agriculture wage rate has grown more than the non-agriculture wage, over the years, for both males and females, although the absolute mean daily wage rate for both agriculture and non-agriculture remains higher for males than women. Clearly, there is a huge wage disparity between males and females. Farm work remains low remunerated, especially for women. The growth rate for agriculture wages has been the same for males and females but wage growth rate for non-farm jobs has been more for women than males. Post-MGNREGA, the earnings of rural women from non-farm work have definitely seen a jump (Table 13.8). This proves sufficient evidence that rural wages have risen considerably, and more non-farm job options like MGNREGA should be encouraged and reformed upon. However, the latest data (Economic Survey of India, 2014–15) on wage growth<sup>6</sup> shows that it has been increasing only at 3.6% (with inflation above 5%) as against 20% in 2011. Part of the reason for this decline

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<sup>6</sup>Further, the latest data from the Labour Bureau suggests that the wages of unskilled casual workers have declined in real terms between November 2013 and November 2015 by 2.14% per annum.

**Table 13.6** Average marginal effects of multinomial regression. Occupation choice regression for rural females, IHDS-II (2012)

|                                        |                       |                   |        |                 |
|----------------------------------------|-----------------------|-------------------|--------|-----------------|
| Number of obs                          | 19,401                |                   |        |                 |
| Wald chi2(66)                          | 1422.86               |                   |        |                 |
| Prob > chi <sup>2</sup>                | <b>0</b>              |                   |        |                 |
| Pseudo R <sup>2</sup>                  | <b>0.071</b>          |                   |        |                 |
| Log pseudo likelihood                  | <b>-0.121</b>         |                   |        |                 |
| (Ref: farm work <sup>a</sup> )         | Non-farm <sup>b</sup> | Farm and non-farm | MNREGA | MNREGA and farm |
| Education attained (ref: illiterate)   | dydx                  | dydx              | dydx   | dydx            |
| Primary                                | 0.06*                 | -0.02**           | 0.01   | -0.02**         |
| Middle                                 | 0.07*                 | -0.03*            | 0.03*  | -0.01           |
| Secondary                              | 0.15*                 | -0.03             | 0.00   | -0.03*          |
| Higher secondary                       | 0.27*                 | -0.05*            | 0.00   | -0.05*          |
| Graduate and above                     | 0.54*                 | -0.01             | -0.04* | -0.07*          |
| Income quintile (poorest)              |                       |                   |        |                 |
| 2nd quintile                           | 0.03*                 | 0.01              | -0.02* | -0.04*          |
| Middle                                 | 0.05*                 | 0.01              | -0.01  | -0.05*          |
| 4th quintile                           | 0.07*                 | -0.02             | 0.00   | -0.05*          |
| Richest                                | 0.05*                 | -0.07*            | -0.02* | -0.048          |
| Marital status (ref: married)          |                       |                   |        |                 |
| Unmarried                              | 0.03**                | 0.01              | -0.03* | -0.038*         |
| Widowed                                | 0.12*                 | 0.038*            | 0.01   | -0.02*          |
| Divorced                               | 0.10*                 | 0.01              | 0.03   | -0.03*          |
| Age                                    | 0.00**                | 0.01*             | 0.00   | 0.018*          |
| Age square                             | 0.00**                | 0.00*             | 0.00** | 0.00*           |
| Number of infants in household         | -0.01                 | -0.03*            | -0.0*  | 0.00            |
| Number of earning members in household | 0.00                  | 0.04*             | 0.00   | 0.03*           |
| Social group (ref: forward caste)      |                       |                   |        |                 |
| OBC                                    | 0.00                  | 0.06*             | 0.01   | -0.01           |
| Dalit                                  | 0.05*                 | 0.08*             | 0.03*  | -0.02*          |
| Adivasi                                | 0.01                  | 0.06*             | 0.00   | -0.01           |
| Muslim                                 | 0.22*                 | 0.02              | 0.01   | -0.07*          |
| Christian/Jain/Sikh                    | 0.10*                 | 0.04              | 0.11*  | 00.00           |

Source Author's calculation from IHDS-I and IHDS-II

Note \*Significant at 5%; \*\*significant at 10%

<sup>a</sup>Farm work includes own farm work and agriculture labour. Excludes animal care

<sup>b</sup>Non-farm work includes own business, salaried work, non-agriculture work. Excludes NREGA

**Table 13.7** Mean sectoral wages and growth rates (gender-wise) over period 2005–2012 in rural areas

| Real mean daily wage               | 2012                      |                              |       | 2005            |                 |
|------------------------------------|---------------------------|------------------------------|-------|-----------------|-----------------|
|                                    | Agricultural <sup>a</sup> | Non-agriculture <sup>b</sup> |       | Agricultural    | Non-agriculture |
| Men                                | 143                       | 172                          | Male  | 94              | 135             |
| Women                              | 95                        | 112                          | Women | 62              | 79              |
| Compound annual growth rate (CAGR) |                           |                              |       |                 |                 |
|                                    | Agriculture               |                              |       | Non-agriculture |                 |
| Male                               | 6.2                       |                              |       | 3.5             |                 |
| Women                              | 6.3                       |                              |       | 5.0             |                 |

Source Author's calculation from IHDS-I and IHDS-II; <sup>a</sup>agriculture includes agriculture wage labour; <sup>b</sup>non-agriculture includes MGNREGA, any non-farm wage work, salaried work

could be the worsening of the agrarian situation and lack of demand<sup>7</sup> from the non-agricultural sector (Himanshu 2016). Using the IHDS panel data set, it was observed that among those households who were poor in 2005, approximately 67% households are no longer poor and only 33% still remain poor in households with rural females currently working in MGNREGA, in the age group 25–60 years based on Tendulkar Poverty line.

### 13.3 Rural Women's Work in Agricultural Sector

#### 13.3.1 Rural Women's Farm Labour Supply

This section quantifies the work participation in terms of how much labor rural females put in agriculture and the determinants of the same. Here farm work includes own (family) farm work and agriculture wage labour. Heckman's selection<sup>8</sup> technique applied in Dasgupta and Goldar (2005) has been used for estimating the determinants of labour supplied by farm rural women labourers. The model is formulated in terms of two equations: first, a selection equation in the form of a binary logit regression to explain the decision of whether or not to participate in the labour market and second, a regression equation to explain days of actual labour

<sup>7</sup>Rural areas have not only seen slackening of demand but also decline in employment generation through public programmes which is in sharp contrast with last five years before 2013 which saw a sharp rise in wages in real terms, at 6% per annum, induced by rising rural demand and also an increase in government spending (*Indian Express*, 27 Feb 2016).

<sup>8</sup>To deal with selection problem while including in the sample, the women who don't participate in workforce and for whom wage information is missing. This technique helps us overcome the problem of not being able to observe the wage for those who are not employed in the reference period.

**Table 13.8** Mean sectoral earnings and growth rates (gender-wise) over the period 2005–2012 in rural areas

| 2012          |                      | 2005                               |        |                 |          |                      |                 |
|---------------|----------------------|------------------------------------|--------|-----------------|----------|----------------------|-----------------|
| Real earnings | Agriculture labourer | NREGA                              | Salary | Non-agriculture | Earnings | Agriculture labourer | Non-agriculture |
| Men           | 10,245               | 2058                               | 46,702 | 14,752          | Male     | 2398                 | 5014            |
| Women         | 5681                 | 2208                               | 23,360 | 4443            | Women    | 1016                 | 604             |
|               |                      | Compound annual growth rate (CAGR) |        |                 |          |                      |                 |
| Earnings      | Agriculture labourer | Non-agricultural                   |        |                 |          |                      |                 |
| Male          | 23                   | Salary                             |        |                 |          |                      |                 |
| Women         | 28                   | 38                                 |        |                 |          |                      |                 |
|               |                      | 44                                 |        |                 |          |                      |                 |

Source Author's calculation from IHDS-I and IHDS-II

market participation in farm work, observable only for those for whom the selection equation takes a value of 1.

For the selection equation, the dependent variable is a dichotomous variable which takes the value 1 if rural woman are in workforce and zero if not. Independent variables include age of rural women worker, age-squared,<sup>9</sup> educational level attainment dummy (Ref: illiterate), income quintile dummy (Ref: poorest quintile), marital status dummy (Ref: married), socio-religious group dummy (Ref: forward caste). Next, for those whom the participation equation takes the value equal to 1, we then calculated the farm labour supply function for rural woman, where the dependent variable is a continuous variable, i.e. days of labour supplied in farm work by rural woman worker for the reference year (2011–2012) and the independent variable is daily agriculture wage rate, participation in MGNREGA (dummy variable takes value 1 if rural woman participates in MGNREGA, else takes zero if not), total number of infants (below 1 year) and total number of earning members in the household, remaining explanatory variable are same as those used in selection equation.

For the selection equation:  $z_i^* = w_i'\gamma + u_i; \dots z_i = 1 \text{ if } z_i^* > 0 \text{ and } z_i = 0 \text{ otherwise}$

Regression model:  $y_i = x_i\beta + \varepsilon_i$ ; observed only if  $z_i = 1$

Error terms ( $u_i, \varepsilon_i$ ) are distributed normally.  $\rho$  is the correlation between  $\varepsilon_i$  and  $u_i$ . The above estimation is done at cross-sectional level for 2012 IHDS data for rural sample of women at individual level.

Table 13.9 shows the result of the Heckman selection technique performed on 2012 IHDS data. It shows that higher the agriculture daily wage rate, more are the farm labour days supplied. Thus, an upward sloping labour supply curve is observed. However, for those rural women farm workers participating in MGNREGA<sup>10</sup> as well, lower are the number of farm labour days supplied. It shows the occupational transitions in panel data for rural women; around 52% of MGNREGA (in any form) and 35% of the exclusive MGNREGA workers were farm worker in 2005. Table 13.3 shows around 68% of rural women engaged as MGNREGA workers were combining it with farm work in 2012. However, the IHDS data shows that only 8% of rural women farm workers in 2012 were MGNREGA workers. Hence, the sample proportion participating in MGNREGA is so small, and it is difficult to reach a conclusion that MGNREGA alone is responsible for reduction in farm days supplied by rural women. It was also observed that higher the level of education and income quintile, lower is the number of farm days of labour supplied. Compared to illiterates, any level of education above primary supplies less farm labour and those rural females who are primary educated are more likely to supply farm labour. As compared to married, unmarried

<sup>9</sup>Square of the age is taken as an independent variable to capture the non-linearity of the age variable and analyse the impact of age on participation in the long run.

<sup>10</sup>Table 13.3 shows approximately 68% of MGNREGA workers combine MGNREGA with farm work (own farm work, agriculture labourer) as a means to supplement income.

**Table 13.9** Heckman selection to estimate farm labour supply by rural women

| Farm days                                                                                                                 | Model 1            | Model 2 (with village control) |
|---------------------------------------------------------------------------------------------------------------------------|--------------------|--------------------------------|
| Daily agriculture wage                                                                                                    | 0.16*              | 0.13*                          |
| Age                                                                                                                       | 15.77*             | 14.73*                         |
| Age (squared)                                                                                                             | -0.19*             | -0.18*                         |
| Number of infants in household                                                                                            | -3.18*             | -3.12*                         |
| <i>Number of workers in household</i>                                                                                     | 0.10               | -0.03                          |
| Participation in MGNREGA                                                                                                  | -20.69*            | -18.44*                        |
| Marital status (ref: married)                                                                                             |                    |                                |
| Unmarried                                                                                                                 | -9.18**            | -10.92*                        |
| Widowed                                                                                                                   | 27.26*             | 26.01*                         |
| Divorced                                                                                                                  | 41.54*             | 38.35*                         |
| Social group (ref: forward caste)                                                                                         |                    |                                |
| OBC                                                                                                                       | 11.27**            | 8.95                           |
| Dalit                                                                                                                     | 15.42*             | 12.98**                        |
| Adivasi                                                                                                                   | 42.06*             | 36.16*                         |
| Muslim                                                                                                                    | -42.69*            | -41.90*                        |
| Christian/Jain/Sikh                                                                                                       | -75.65*            | -70.89*                        |
| Education attainment (ref: illiterate)                                                                                    |                    |                                |
| Primary                                                                                                                   | 4.48               | 6.48**                         |
| Middle                                                                                                                    | -24.62*            | -23.22*                        |
| Secondary                                                                                                                 | -45.05*            | -42.37*                        |
| Higher secondary                                                                                                          | -86.56*            | -81.45*                        |
| Graduate                                                                                                                  | -112.36*           | -101.10*                       |
| Participation in workforce (dependent variable takes value 1 if rural women participate in workforce, else 0 if does not) | selection equation |                                |
| Age                                                                                                                       | 0.17*              | 0.17*                          |
| Age squared                                                                                                               | 0.00*              | 0.00*                          |
| Marital status (ref: Married)                                                                                             |                    |                                |
| Unmarried                                                                                                                 | 0.02               | 0.02                           |
| Widowed                                                                                                                   | 0.22*              | 0.22*                          |
| Divorced                                                                                                                  | 0.47*              | 0.47*                          |
| Income quintile (ref: Poorest)                                                                                            |                    |                                |
| 2nd quintile                                                                                                              | 0.03               | 0.03                           |
| Middle                                                                                                                    | 0.05**             | 0.05**                         |
| 4th quintile                                                                                                              | -0.09*             | -0.09*                         |
| Richest                                                                                                                   | -0.49*             | -0.49*                         |
| Social group (ref: Forward caste)                                                                                         |                    |                                |
| OBC                                                                                                                       | 0.56*              | 0.56*                          |
| Dalit                                                                                                                     | 0.69*              | 0.69*                          |
| Adivasi                                                                                                                   | 0.99*              | 0.99*                          |

(continued)

**Table 13.9** (continued)

| Farm days                                | Model 1 | Model 2 (with village control) |
|------------------------------------------|---------|--------------------------------|
| Muslim                                   | -0.23*  | -0.23*                         |
| Christian/Jain/Sikh                      | -0.93*  | -0.93*                         |
| Educational attainment (ref: Illiterate) |         |                                |
| Primary                                  | -0.17*  | -0.17*                         |
| Middle                                   | -0.46*  | -0.46*                         |
| Secondary                                | -0.81*  | -0.81*                         |
| Higher secondary                         | -1.02*  | -1.02*                         |
| Graduate                                 | -1.64*  | -1.64*                         |
| Mills                                    |         |                                |
| Lambda                                   | 93.41*  | 86.86*                         |
| Rho                                      | 0.86    | 0.83                           |
| Sigma                                    | 109.04  | 104.38                         |
| Number of obs                            | 52,159  | 52,159                         |
| Censored obs                             | 45,032  | 45,032                         |
| Uncensored obs                           | 7127    | 7127                           |
| Wald $\chi^2(20)$                        | 459.72  | 708.14                         |
| Prob > $\chi^2$                          | 0       | 0                              |

Notes \*Significant at 5%; (\*\*) significant at 10%; number of days in an year capped at 365 days; hours per day capped at 8 h)

rural women are less likely to supply farm labour, whereas widowed and divorced are more likely to supply farm labour. Compared to forward caste, rural women from all other socio-religious caste groups (except Muslim, Christians, Jains and Sikhs) are more likely to supply farm labour especially the Adivasis. These results are similar to those obtained in Bardhan (1979) where rural women from backward classes were more likely to participate in agriculture work.

### 13.3.2 *Exploring a Shift Away from Agriculture for Rural Women*

The NSSO (68th round, 2011–12) data shows that the share of agriculture in total workforce has come down to 49% and reports large number of workers moving out of agriculture. Based on IHDS panel data, Table 13.10 shows that the number of farm days<sup>11</sup> has reduced for both men and women, but more for males in rural areas. On the other hand, non-farm days have increased more for males. This reflects lack of employment opportunities and entry barriers for non-farm jobs for

<sup>11</sup>Farm work constitutes self-employment in own farm and agriculture wage labor.

**Table 13.10** Number of days worked for rural males and rural females

| <i>No of days worked<br/>(mean)</i> | 2012–11 |  | 2005 |  | 2012–11 |  | 2005 |  |
|-------------------------------------|---------|--|------|--|---------|--|------|--|
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women in rural areas, making farm work the only easily accessible income earning option. It could also imply that household income position could have risen, which has reduced the pressure to work and has led to withdrawal of women from labour market, who choose to attend domestic duties instead or pursue higher education. Non-farm days have been increased particularly for rural women with higher secondary and above education attainment, Dalit, Muslims, Christians, unmarried. Farm days have not reduced much at all-India level for rural women. But farm days have reduced for rural women who are married, mostly in the 30–39 years age group, forward caste, Dalit and rural women with graduate and above level of education.

### 13.4 Main Findings

This chapter analyses the changes in work participation among the rural women workers during 2004–2005 using IHDS panel data. Broad results suggest that in rural areas, shifting out of agriculture is mainly for males with non-farm jobs having high entry barrier in the form of higher education and skill. Majority<sup>12</sup> (49%) of rural women farm workers in 2011–12 were farm workers back in 2004–2005 too. With limited job opportunities, agriculture still remains as the main job option of women as also noted in the literature although rate of growth in agriculture employment has fallen. Majority of the non-workers (of 2004–2005) are currently in salaried jobs. This reveals their preference for regular high paying jobs with rise in their income and education standards, the lack of which may force them to withdraw from market. Number of farm days have not reduced much for rural women as compared to rural males. However, those rural women with higher level of education, higher income quintile, belonging to upper caste, those in 30–40 year age group, unmarried women, married with household responsibilities of child rearing have witnessed a reduction in their farm days of labour supplied.

MGNREGA is, thus, observed to be an income earning avenue for the illiterate, backward classes and poor rural women who are stuck in low remunerated farm work. It was further observed that participation in non-farm opportunities like MGNREGA does cause significant reduction in labour supplied to agriculture. However, workers under MGNREGA constitute a very small proportion of farm workers to be able to reach any conclusion, despite the evident transition in the form of shifting out from farm work to exclusive MGNREGA jobs. The programme has been somewhat successful in targeting the marginalized rural women who are poor, illiterate and from backward classes like Dalit and OBC. It has a poverty reducing potential. But it provides just an additional income opportunity for women, most of which is found to be combined with farm work. On the other hand, with a rise in the level of income and education, rural women prefer non-farm jobs

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<sup>12</sup>Refer Table 13.1.

as opposed to farm work, combined work or MGNREGA work. These findings call upon the need for more productive jobs and skill development, on a massive scale; to make jobs, especially non-farm jobs, accessible for all and creating employment opportunities preferably closer to home for rural women.

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